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NOTES FOR THE MONTH.

Continuous Wheat Growing.

It has long been a tradition of farming that two white-straw crops should not be grown in succession, and the tradition still lives although it is generally known that there are numerous cases in which the practice has been a success. The classical proof that white-straw crops can follow one another without deterioration of the land is afforded by experiments at Rothamsted Experimental Station, where wheat has been grown continuously on the same land for 73 years, with only two seasons' break for fallow, and barley has been grown for 63 years with only one season's fallow. In similar experiments at Woburn, on a much lighter soil, forty-four crops of wheat have been taken off the same land without any break, and forty-four crops of barley off the barley plots. As a commercial proposition, wheat was grown almost continuously for 50 years on Mr. Prout's land at Sawbridgeworth. Other instances are also known, particularly on chalky boulder clay, where wheat has been grown for a succession of years on the same land, and it may be taken as proved that the practice is quite feasible.

In the case of the continuous wheat crops at Rothamsted there has, of course, been a falling off on the unmanured land, but this is less than might have been expected; for the last 40 years the yield has been fairly steady, and has averaged 11½ bushels, against 17½ bushels for the first five years of the experiment. The plot supplied with farmyard manure shows no falling off, but on the contrary, a rise; for the first eight years the yield averaged 28 bushels, and for the last ten years 35 bushels. Except in a few really bad years, such as 1879, 1904 and 1912, the crop has been consistently good; while

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often, as in 1892, 1893 and 1900, it has still been good in spite of the big drop in the average yields for the whole country. The most interesting plot for the present purpose, however, is that supplied with complete artificials. For the first 30 years the yield was well above that on the dunged plot. It has fallen off since, but it was maintained for a sufficiently long period to show that no falling off need be anticipated in practice.

The advantages of rotations are so obvious that no one would advocate any general suspension, but there are, in the South of England, large areas of clay land where the possibility of introducing some system of continuous wheat growing in which both grain and straw would be sold is a matter for serious consideration. In such counties as Essex, Hertford and Middlesex, for instance, there is a ready sale for straw. Farm buildings for the winter feeding of stock are often lacking or are at best inadequate, and the difficulties attached to growing roots on the heaviest soils make the winter fattening of stock on ordinary lines quite out of the question. The productivity of such soils under wheat can be maintained for any length of time by comparatively inexpensive dressings of artificial manure, and autumn is the one season in which it is safe to rely on being able to sow any crop. The only real difficulty lies in keeping the land clean and in getting through the necessary cultivation in the short period between the harvesting of one crop and the sowing of the next. To overcome both these difficulties it is practically essential to be able to command steam tackle. If this is available as soon as harvest is over, the autumn cultivation presents no special difficulty in an average season, and by its aid any fallowing which may be required is cheaply and effectively performed.

With proper management a really bare fallow will seldom be necessary. As the land shows signs of becoming too foul for autumn treatment to suffice, clover may be sown down in the wheat and cut for hay early in the following season. An alternative plan is to sow crimson clover or winter oats and vetches in autumn. In either case the hay or silage crop will be cleared by the beginning of July, and the land may then be half fallowed.

A crop of beans sown in rather wide rows, say 30 inches, and cleaned by horse and hand hoeing, answers the same purpose in a different way.

A modification of the system referred to is already practised

in certain chalky-clay areas of the south where arable sheep farming has gone out of fashion and where even bullocks are not fattened to the same extent as formerly. Under the changed conditions the proportions of the various crops would normally be as follows:—

Corn, mainly Wheat	... ...	50 per cent.
Clover	... ...	15 " "
Beans	... ...	15 " "
Bare Fallow	...	15 " "
Roots, etc. ...	...	5 " "

Farming on these lines is suited to big holdings and large open fields, where labour-aiding machinery and implements can be used to the best advantage.

Provided artificials are used judiciously and in adequate amount, and provided also that the rotation contains a proper balance of clover, beans and other leguminous crops, and that the fallows are energetically and skilfully tackled, there need be no fear either of foul or of impoverished or of ill-working land under this system.

Manuring Wheat taken after Wheat or Another Corn Crop.—Generally speaking, farmyard manure would be better applied to such crops as potatoes, cabbages, mangolds, and even swedes and turnips, than to wheat. The latter crop, therefore, in most cases receives artificials alone. Generally some 2 or 3 cwt. per acre of superphosphate or 5 cwt. of basic slag should be applied before sowing the wheat, and from 1 to 1½ cwt. per acre of sulphate of ammonia or nitrate of soda as a top dressing in early spring. In some cases a satisfactory response would be obtained if larger dressings of nitrogenous manures were given.

When 1½ cwt. of nitrogenous manure per acre is applied, a small part (not more than ½ cwt.) of this might be mixed with superphosphate and given at the time the wheat is sown, or if basic slag is used instead of superphosphate, it may be given after the slag has been harrowed in. On no account should sulphate of ammonia and basic slag be mixed together. In any case the greater part of the nitrogenous manure should be given as a top dressing in spring.

Where land is known to benefit from potash fertilisers—usually light land and peaty soils—a dressing of 2 cwt. of kainit or 1 cwt. of 30 per cent. potash salts might be given.

Disposal of Straw.—The style of farming above described is, of course, mainly applicable at present where there is a sale for straw.

Recent work at Rothamsted has, however, demonstrated the possibility of synthetic production of farmyard manure from straw and artificials without the use of animals at all. The straw is allowed to decompose, forming humus, and the necessary nitrogen compound is supplied in the form of an ammonium salt. The details of the method are being fully worked out at Rothamsted.

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Sowing of Wheat.

IN view of the great need to grow more wheat at the present time, the following notes on the more important points which should be considered in sowing are in season :—

Preparation of Seed Bed.—On the typical wheat soil of East Anglia—chalky boulder clay—the weight of evidence in respect of bare fallows or half-fallows seems to be in favour of preliminary deep cultivation, either by plough or cultivator, followed by more superficial workings to secure a deep tilth firm below and relatively loose and fine above. When this stage is reached further ploughing is deemed a mistake, as tending to promote " root-fall " and lodging of the crop.

After a fallow crop, for which the land has already been deeply tilled, fleet ploughing for wheat is the rule, but some farmers obtain excellent results by ploughing at least 8 inches deep and pressing afterwards. Following potatoes, cultivating without ploughing is a common and successful practice. So long as a firm, yet penetrable, bottom tilth, combined with a looser, freer tilth at the surface, is obtained, the mode of accomplishment appears to be relatively unimportant.

Seed.—Trials show that so long as pure seed is maintained, the same stock may be used year after year on the same farm without risk of diminished productivity. In late wheat-growing districts a change of seed may be an advantage. Seed from an early district will be found to mature sooner and be less exposed to the dangers of a late harvest.

In every case the seed must be clean, healthy and of good germinating capacity. Every year many crops fail, either wholly or partially, through neglect on the part of the farmer to perform a simple germination test.

The question of the choice of variety is more difficult. One is better suited to a particular set of conditions than another. Local experience is generally the best guide, but farmers who have not yet tried " Yeoman " would be well advised to do so.

It is a heavy yielder of grain of superior quality, yet it is easily handled at harvest time, for its straw is moderate in amount and possesses exceptional standing power. There is probably no variety of wheat in general cultivation so well suited to rich land or so well adapted for yielding a profitable return on fertilisers.

Method and Rate of Sowing.—Only broadcasting and drilling need be considered. The former economises time and labour at the expense of a slightly greater quantity of seed: the latter economises seed and generally ensures a more uniform covering, but increases the cost of labour. The first renders hoeing and weeding of the crop impracticable; the second, particularly when the rows are wide enough apart, facilitates such operations.

Where there is sufficient tilth, the seed may be broadcasted and ploughed in, or, as in the case of large areas on the Downs, broadcasted by the machine fitted with cultivating attachment. From the standpoint of yield, there seems little doubt that drilling is preferable to either of those methods. Where the cart-wheel method is adopted, as in Kent, the broadcast seed is deposited on relatively wide ruts at a uniform depth and at intervals of 9 inches or so from row to row. In such circumstances individual plants have more room to develop than when compressed into a narrow seam, as is the case with some of the modern drills. Consequently, the crop stands up better at harvest and, though comparative data are lacking, there is no doubt that exceptionally heavy yields are obtained by the Kent method.

The question of the best depth of covering is likewise one on which no reliable data are available. A drill has recently appeared the principle of which is to distribute the seed thinly (about 1½ bushels per acre) by coulters, 3 inches wide and 9 inches apart, which barely enter the ground at all. The seed is lightly covered with soil by two cultivating attachments fixed behind each coulter, the effect being to leave the surface of the field in slightly raised ridges. The surface tilth required is much finer than that usually considered desirable for a crop which is to stand the winter, but no serious "capping" results, and the little that is found yields readily to a set of light "Parmiter" harrows run over the wheat in spring. Fertilisers are deposited in the row with the seed but do not come into direct contact with it. The result, as seen in a field near Chelmsford, is a wonderfully strong, upstanding plant with numerous tillers all the same length and with long, full ears of equal size. The general

appearance of the crop is in marked contrast with adjoining lots sown by other drills where the straw is finer and weaker, the ears shorter and many tillers only half developed.

Examination of the root systems of the several lots discloses interesting differences. In the case of wheat sown in the ordinary way there are two tiers of roots on each plant, one well below the surface level, the other near the surface. In the case of the new drill referred to, all the roots are practically at the surface; they are stronger and longer, the topmost acting as surface anchors after the manner of tree roots. These differences would seem undoubtedly to bear some relation to standing power. An important factor in crop production is the power of the straw to stand. If by practicable cultural methods this can be improved, an enhanced yield and a profitable return for liberal manuring would be rendered much more certain.

Over-thick seeding tends to weaken straw; on the other hand a very thin crop is likewise easily knocked down. The limit in the case of drilling seems, in general, to be between 1½ and 3 bushels per acre. Where 2 bushels are drilled, possibly 3 should be broadcasted, but much depends on soil, climate, variety, and time of sowing. For broadcasting on the Kent system and under rich conditions, 7 pecks are considered enough for October sowing, and 8 to 10 pecks for November or December. Under the poorer and more exposed conditions of the Downs, up to 3½ bushels per acre are sown. A useful motto is "Sow early and save seed."

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Milking Machines.

IN a report on the use of milking machines, prepared in 1917 for the Committee on the Production and Distribution of Milk and printed in its Final Report, one of the conclusions stated is that "good results cannot be expected unless the parts of the machine which come in contact with the milk are thoroughly cleansed after each milking."

Dr. Thomas Orr, Medical Officer of Health for Ealing, in the issue of *Public Health* for March last, discusses the milking machine both in its general aspects and also from the point of view of clean, that is to say, bacteriologically clean, milk. After sketching the genesis of the milking machine, and paying a tribute to Dr. A. Shiels of Glasgow, whose machine, in 1891, was the first to be provided with the pulsating device to

imitate the natural sucking of a calf, the writer gives an account of the mechanism of the ordinary types. He then passes on to the question of the efficiency and suitability of the machine, and records his conclusion that it may be considered comparable with average hand-milkers. No reduction of the milk yield need be anticipated from its use. It is, however, advisable to strip the cows by hand after machine milking. If care is taken to apply teat-cups of the proper size, no injurious effect on the health of the cows or on the teats and udder need result. The saving of labour has been estimated at from 30 to 40 per cent., but it is not profitable to instal a milking machine for less than 30 cows.

Dealing next with the main question of his paper, the writer points out that milk produced under good conditions may contain less than 5,000 bacteria per cubic centimetre. The standard for certified milk in the United States is 10,000 bacteria per cubic centimetre. He quotes instances, however, of bacterial contents of machine-drawn milk "ranging from 71,000 to 395,000 . . . with as many as 1,208,000 bacteria per cubic centimetre . . . a bacterial content of 509,000 per cubic centimetre when the machine received only average care," and reinforces these by his own experiences of "two different machines giving milk with 494,000 and 1,392,000 bacteria per cubic centimetre respectively." Such figures, Dr. Orr remarks, may surprise the casual observer to whom a milking machine appears to be an ideal method of taking milk from the cow.

No doubt certain important sources of contamination are guarded against by the use of a milking machine, but other sources arise through the nature of the apparatus. Milking machines render milk liable to contamination from three sources:—(1) material from a diseased or gargety udder; (2) air and dirt sucked in when the teat-cups fall off; and (3) the serious contamination from the cups and tubes of the machine, which can be kept clean only by exercising the strictest care. Contamination from the first-mentioned source may be prevented by examining beforehand the teats and udder of the cow—this is an essential procedure in ordinary hand-milking. The second source is more difficult to deal with, but if the teats are kept clean and fitted with cups of suitable size, the risk of the cups falling off may be reduced to a minimum. It is the third source of bacteria which requires most attention. Great care should be taken to keep clean those parts of the machine with which the milk comes into contact, namely, the cup and its rubber parts, the "claw," the

milk tubes, and the receiver. It is at all times difficult to free these parts from the residual milk after the milking operations, and in summer, when the warm weather favours the multiplication of bacteria, special difficulty is likely to be experienced with machine-drawn milk. Cleansing or sterilising would be a more simple matter if boiling water or steam could be passed through the apparatus. While this can be done with the metal parts, it is impracticable with the rubber linings and tubes, which would quickly perish under such treatment. It is, therefore, necessary, in order to ensure cleanliness in production, for each part of the machine to be detached and cleansed separately in a particular way.

Experiments have suggested that the best liquid for cleansing the rubber parts is a solution of brine and chloride of lime; 10 lb. of common salt and ¼ lb. of chloride of lime added to 7 gallons of water have been recommended. As this solution deteriorates, chloride of lime should be added each week. The procedure in cleansing is first to wash out the machine by sucking clean water through it, followed by warm soda water to get rid of any trace of milk and to prevent the deposition of fat, and then by warm water to get rid of the soda. Finally, the whole apparatus from the receiver to the teat-cups should be taken apart; the receiver, "claw" and metal parts of the cups cleansed or sterilised by steam or boiling water; and the rubber tubes and linings should be kept in the brine and lime solution until the next milking, when they should be rinsed before using. The salt bath has no injurious action on the rubber, and in fact acts as a preservative.

These operations naturally take time, but such cleansing is necessary to ensure that the milk obtained shall be of good quality. Provided that every care is taken in cleansing the machine, and that cotton filters are used for the air reliefs in those machines in which they exist, milk of a very high grade may be obtained, comparable with that produced under the best conditions by hand.

Having given these directions, Dr. Orr offers a comforting pendant to the gruesome picture with which he illustrated the necessity of cleanliness. In 1906 Erf, in a series of 12 experiments, found a bacterial content of 3,700 per cubic centimetre in hand-drawn milk and 2,200 per cubic centimetre in machine-drawn milk—both produced under the best conditions. Stocking and Mason (1907), in a similar experiment, obtained the following figures:—Hand-drawn, 4,560; machine-drawn, 1,578.

Other reassuring figures are quoted, closing with those of Hooper and Nutter who, in 1914, examined 220 machine-drawn samples from a private farm, which averaged as low as 4,624 bacteria per cubic centimetre, only 14 samples exceeding the certified limit of 10,000.

Dr. Orr has certainly made out an excellent case for the necessity as well as for the possibility of cleanliness in milking machines.

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Rural Education in Wales.

An experiment* made at the Welshpool County School for Boys to give an agricultural bias to the ordinary school teaching has aroused considerable interest in the schools of England and Wales, and important developments may take place. So important was this experiment deemed by the Board of Education that a grant was made to the School for the year 1913-14, and for the two subsequent years, in order to assist and encourage the work and also to test its effect on the general course of education. If the example of the Welshpool School is widely followed in the schools of Great Britain the results may be of far-reaching importance.

The Welshpool County School is situated on the rich alluvium of the Severn Valley, in the eastern portion of the county of Montgomery, and has an average of 100 students, of whom about half are farmers' sons. Efforts to give an agricultural trend to the teaching date from 1908, when the Agricultural Department of the University College of Wales, Aberystwyth, sent a member of its staff to give instruction, one day each week, consisting mainly of specially useful and applied points in agricultural chemistry, combined with farm visits for the observation of crops and farming operations. A school garden was laid out, arranged for practical and observational work, and planted with bush and fruit trees. These arrangements continued for two years, and will doubtless prove beneficial to the boys. In 1919 a master to take charge of the rural work of the school was added permanently to the staff; a Rural Room or Agricultural Laboratory was built; and half an acre of land adjoining the school was secured for outdoor work. It was considered that it was not the duty of a secondary school to give definite training in the technical and manual processes of agricultural practice,

*"Education in Wales: The experiment in rural secondary education at Welshpool County School for Boys—(Welsh Department, Board of Education, 1920. Price 2s. 6d. net).

and consequently, in adapting the school curriculum, only those parts of a physics syllabus were retained that were essential to a boy's general training and had definite application to agriculture. Botany and elementary Animal Biology were also introduced.

Only a brief outline of the plan of study can be given here. The science course in Form II (first year) consists of lessons in experimental science, which includes physics and chemistry; and nature study, comprising plant and animal life. In Form III (second year) the experimental science course deals with the factors bearing on soil temperature; the chemistry course includes experimental studies of air and water; and the botany class studies seeds, roots, stems and leaves; while the outdoor work includes pruning. The agricultural science class studies the soils and crops of the school district; the animal biology work deals with the structive and life history of insects, bird life, moles and voles, with their enemies the stoat and the weasel; and cultural work on the germination of seeds.

In Form IV the botany syllabus includes a study of the nutrition of plants, practical outdoor work on the vegetative reproduction of plants, and the raising of seeds of mangolds and swedes from the best representatives in the plot. Agricultural science work comprises a study of the physical properties of soils, the effects of the various tillage operations on the soil, plant food, manures, types of farm crops, and the composition of milk. Collections of local soils and subsoils are made, and culture work in plots is carried out.

Form V (fourth year) chemistry includes a study of sulphur and nitrogen compounds, and the manufacture of nitrate of lime and its use as a fertiliser. The agricultural botany work deals with seeds of grasses and clovers; the fungi causing various diseases are investigated and methods of prevention and treatment shown. In the outdoor work, the spraying of potatoes and fruit trees is undertaken, and at the invitation of the local Food Production Committee the school has organised the spraying of potatoes in the district. Agricultural science work deals with the manufacture and composition of manures, soil improvement, crops and their relation to the soil in which they grow, as well as the chemical changes occurring in plants, feeding stuffs, nutrition of animals and plants, farmyard manure, chemistry of the dairy, and cultural work in plots.

In addition to the general science scheme outlined above, other subjects of school study are given a rural application. Arith-

metic includes problems dealing with farming practice, such as the measurement of stacks, areas of fields, and valuation of manures from the percentages of composition. Later, it is hoped to introduce a section dealing with the mechanical principles underlying the construction and working of farm implements and machines. In geography, the school district forms the first area of general study, and the boys are instructed in the use of ordnance maps. Rainfall, barometer and thermometer readings are taken in connection with the School Meteorological Station, and the relation between the climate of the neighbourhood and local farming operations is noted. Efforts are made to stimulate interest in woodwork by the construction of models that are of direct agricultural interest, such as nesting boxes and beehive frames. A rural trend is also given to such subjects as drawing, English literature, history (including the history of agriculture), Welsh and Latin.

The school garden is well stocked, and is especially useful for the practical study of insect pests and measures of control. The students take part in the operation of planting, and are taught the operations of pruning, grafting and budding of fruit trees. Numerous experiments are carried out, some of which are designed to illustrate the effects of various fertilisers on different crops, while others show the results of sowing seeds at various times and at different depths. The remainder have reference to such subjects as continuous cropping and a comparison of varieties of potatoes with regard to crop production and immunity from disease. Practical studies are made of mangolds, sugar beet, parsnips, carrots, swedes, turnips, oats, barley and rye, all of which are grown in the school plot. Records of all experiments are kept by the students, who are allowed to enter the plot at any time for the purpose of making observations. The Ministry's leaflets are extensively used.

Farm outdoor work includes seasonal visits to the Home Farm (1,200 acres) of the Earl of Powis, thus providing opportunities of observing methods of cultivation, varieties of stock and implements. A report is prepared by the students and is published in the local press each year on the results of the plot experiments that are of particular interest to local farmers. Nearly all the operations in the cultivation of the school garden and plot are performed, under direction, by the boys themselves, as it is considered that, if the students were mere spectators, their interest would be only partial and the educational benefit lessened.

Apart from its general educational value, the scheme of rural science work is believed to be specially suitable for boys who hope to proceed to a University College with a view to taking a degree in agricultural science subjects. Although they will have received no instruction in technical farm processes, they have obtained a fair insight into those sciences that are basal to agriculture or indirectly bear on the industry. Agricultural scholarships, tenable at a University College, provide a stimulus for further education in the case of students who look to the land for their career. It is the experience of the school that many boys who intend to take up farming at home leave school at the end of their third year, at the age of 15 or 16. These boys will have done work specially arranged for them on the school plot, and are exactly the type for whom the more technical instruction of a Farm School or Institute or the University College short courses in agriculture would be suitable. Many are already receiving County Council grants for this purpose.

The introduction of a rural trend in the various subjects has not, it is believed, interfered in the least with the success—examinational or intrinsic—of pupils of the more academic type. On the contrary, it has contributed to the basis of a good general education, and has tended to make the students more alert, giving them a wider outlook.

It is felt that one effect of training on the lines indicated will be to give to the pupils, and through them to their parents and a wider public, a fuller realisation of the economic importance of the land—the nation's greatest asset—and a deeper interest in the countryside. Agriculture is the basal and most vital industry of this or any other nation, and is a fascinating subject of study. There is something in the touch of Mother Earth that makes for joy and health and life.

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Jam-making when Sugar is Scarce.

IN view of the necessity for exercising the greatest economy in the use of sugar at the present time, and the desirability of conserving the largest possible amount of fruit, the following information, contained in Leaflet No. 354, issued by the Ministry, is here reprinted :—

With the present price and short supply, it is necessary to economise considerably in the amount of sugar used for making jam. Glucose can be thoroughly recommended as a sugar

substitute when used in the proportion suggested below, because :—

(*a*) It is cheaper.

(*b*) It will yield an equivalent weight in jam.

(*c*) It will reduce the tendency of jams to crystallize (sugar-coat).

The best kind of glucose for jam-making is in syrup form and is known as Corn Syrup or Corn Sugar. Glucose chips do not yield such satisfactory results as glucose syrup, and are not recommended.

Selecting and Preparing the Fruit.—See that the fruit to be used is in clean and sound condition. Do not use over-ripe fruit; it is better that it should be slightly under-ripe. Wash well in cold water, with the exception of soft fruits, like raspberries, strawberries, &c.; these would lose a great deal of flavour if so treated. Preparation of fruit varies somewhat according to the kind; *e.g.*, gooseberries should be topped and tailed, currants lightly shredded from their stalks, rhubarb skinned and cut into pieces of a uniform size, and the hulls should be removed from raspberries.

Jam-making with Glucose and Sugar.—Glucose cannot be used alone as a substitute for sugar. It should only be used *with* sugar and then only up to the proportion of one-third of the quantity of the latter. The combined quantity of sugar and glucose should be equal to that of fruit when under-ripe fruit is used. With ripe fruit, the quantity of glucose should be slightly less.

Put the fruit into a preserving pan and add just sufficient water to break down the texture when the fruit becomes heated; ripe fruit requires less water than green fruit. Add the sugar, and stir until completely dissolved. Add the glucose (Corn Syrup) after the sugar crystals have all been dissolved. Boil rapidly, stirring briskly to prevent burning. The point at which boiling may be stopped can be ascertained by testing a little of the jam on a cold plate; if there is no sign of its becoming firm on cooling, keep on the boil until a " set " is obtained. Over-boiled jam is usually too stiff and solid, and consequently is not so appetising as when correctly boiled.

When poured into jars the jam should be covered as soon as it is cold either with waxed paper or a thin sheet of paper dipped in brandy or other spirit. The jars should then be tied down tightly with parchment paper and stored in a cool dry place.

Points to watch to avoid Failure.

1. *Over-ripe* fruit makes jam of poor consistency. It must be boiled longer and thus to a less weight. Jam made from it is therefore more expensive.
2. When using glucose, add it after the sugar has dissolved. Glucose has a tendency to burn if added too soon.
3. Do not use more than one-third glucose to the weight of sugar. Ripe fruit must not have as much glucose in proportion to sugar, *i.e.*, use less than one-third.
4. Ripe fruit requires slightly less sugar, *i.e.*, if using 6 lb. of very ripe fruit use 5 lb. of sugar and glucose.
5. The pan should be not more than half-full when all the ingredients are added; this allows for rapid boiling.
6. *Boil quickly; do not simmer.* Correct boiling will produce slightly less jam in weight than the total of fruit and sugar together put in.
7. Allow the jam to *cool down thoroughly* before placing covers on jars.

Suggested Recipes.

Gooseberry Jam, with sugar and glucose:—

8 lb. green gooseberries.
Little water (to break down texture).
6 lb. sugar.
2 lb. glucose.

Weight when finished—approximately 14½ lb.

Plum Jam, with sugar and glucose:—

8 lb. under-ripe plums (Pershore (egg) plums are the best for this purpose).
Little water (to break down texture).
6 lb. sugar.
2 lb. glucose.

Weight when finished—approximately 12½ lb.

With ripe fruit use 1½ lb. of glucose and 6 lb. sugar. If no glucose is used the weight of sugar when added should be approximately equal to that of the fruit.

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Substitutes for Hay.

SHORTAGE of grass can be made good in several ways, and farmers anxious to increase their stock of winter fodder will sometimes find a fair amount of autumn keep in maiden seeds. These, however, must be grazed with great care if the future of the crop is not to be endangered. After a covering crop has

been harvested, the seeds should be rolled, to effect consolidation and to promote tillering. Before being depastured the plant should be allowed to establish a firm and fairly deep root-hold as a protection against winter frosts, spring drought and the risk of being uprooted by stock. Grazing is useful in the cases of such short-lived plants as Red Clover which, if allowed to reach or even approach maturity in its first autumn, will perish to a large extent before spring. Grazing will check this, and also reduce the risk of "clover sickness" and encourage the branching of such grasses as may have been included in the seeds' mixture.

For winter feeding, hay may be wholly or partially replaced by the straw of oats, barley and wheat. The riper the straw becomes the tougher it is to chew. While barley should not be cut until it is dead ripe, oats and wheat may, with advantage, be harvested a little before that stage is reached. In general, spring-sown cereals are less fibrous than winter-sown, and are consequently more nutritious. For fodder, oat-straw is preferred, but barley-straw containing a proportion of grass and clover is also useful. Cereal straw is relatively rich in carbohydrates and uniformly poor in albuminoids; consequently the proportion of albuminoids must be increased in the ration. This can be done by the addition of cakes or meals. Straw for fodder is best chaffed and mixed with slices or pulped roots, crushed cake or meal and treacle water, and allowed to stand overnight. A slight fermentation ensues, softening the straw and further adding to the palatability of the mixture. In order to save straw for fodder, more bracken and peat moss should be used as litter.

Bare pastures may be supplemented by vetches, maize, cabbages, early turnips and mangold roots, but where these are scarce, potato tops may be found useful. These should be cut just after they begin to turn yellow, and should be fed on grass-land, but *not* on grass which is to be broken up for potatoes next year, as this might cause disease to be transmitted. Green tops should be sparingly used, those dried in the sun and wind being preferred. Tops bearing many blossoms or unripe fruits should be avoided. They should be as free from earth as possible and be fed in small quantities. White mustard, provided that it can be sown by the end of August, is another substitute which may be broadcasted among stubbles. If not required for sheep-feeding the crop may with advantage be ploughed in as green manure.

Formerly, gorse or furze was used in this country as food for stock, and was even specially cultivated for that purpose. It is of two types—the ordinary prickly gorse, and the French or fox-tail gorse, which is relatively free from spikes. The latter is to be preferred, but ordinary gorse, if thoroughly pulverised, may be fed to stock with good results. Gorse for fodder is usually crushed between rollers. It should not be allowed to lie long in bulk as it ferments and becomes sour and unpalatable. In the case of old-established gorse only the green tops are fit for feeding. Old gorse coverts, however, may be reclaimed by cutting down the woody plant as close to the ground as possible and dividing the roots freely. In from one to two years the subsequent young growth will be ready to cut. Gorse is highly nutritious and has proved satisfactory with all classes of farm live stock, especially with horses and milch cows. It should form only one part of the ration, as when fed to excess it proves too heating, an effect which may be counteracted by giving an occasional bran mash or a daily allowance of roots. Up to 20 lb. per head daily is a safe ration for horses and cows. In the Woburn experiment in gorse cultivation the crop was put through a gorse cutter and fed to sheep with swedes. The sheep ate readily up to 2½ lb. per head per day of fresh gorse, and throve well upon it. Gorse-studded areas provide a useful winter range for young horses.

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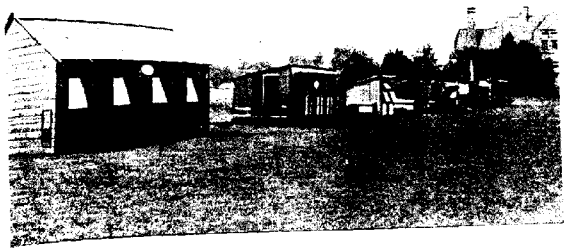
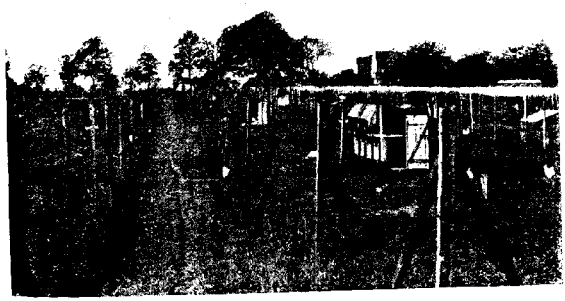
Improvement in Poultry Keeping.

THE fact that this country has in the past ten years paid an average of nearly £8,000,000 a year to foreign and colonial countries for poultry and eggs, and in 1919 paid rather more than £10,000,000, indicates that there is an enormous demand for these products and that our own producers are unable to satisfy it. The number of poultry kept per head of the population is stated to be far below the figure for the United States, and the reason for this doubtless is that our farmers do not yet fully realise that there is money in poultry keeping. Research is certainly necessary to inform us as to feeding, breeding, laying capacity, and diseases, but education is also necessary to convince our people of the desirability and practical value of poultry keeping, and to keep them informed how birds should be managed to ensure the best results.

At the fourth annual poultry conference, held at the Harper Adams Agricultural College, Newport, Salop, from 10th to 12th August, and presided over by Principal P. H. Foulkes, many



Poultry Houses exhibited at the Harper Adams Poultry Conference.



General View of Egg-Laying Trial Pens at the Harper Adams Agricultural College.

White Leghorns: Part of a Pen in the Laying Trials, Harper Adams Agricultural College

Light Sussex: Part of a Pen in the Laying Trials, Harper Adams Agricultural College

matters of importance to present or prospective poultry keepers were discussed, papers being read by outstanding authorities and followed by discussions, in which many of the most practical breeders in the country took part. In regard to laying trials, papers were read by Mr. Tom Barron on "The Value of Laying Trials"; by Rev. Lewis Jones on "Laying Trials as Viewed by a Breeder of Exhibition Stock"; and by Mr. W. J. Corbishly on "The Proper Basis of Valuation." Education and Research received very full consideration, papers being read by Mr. P. A. Francis (Ministry of Agriculture) on "Education in Poultry Keeping"; Mr. F. W. Parton (University of Leeds) on "The Universities and the Industry"; Mr. F. W. Rhodes (Lecturer at Harper Adams Agricultural College) on "Poultry Education for Ex-Service Men"; Mr. Edward Brown on "Poultry Education in America"; Professor Charnock Bradley (Principal, Royal (Dick) Veterinary College, Edinburgh), on "Research in Poultry Keeping," and by Mr. Tom Newman on "Research in Incubation."

The third day was devoted to papers on the commercial side of the subject, a paper being read by Mr. Oscar Brown on "Ducks as Egg Producers," while other papers discussed commercial egg farming, co-operation, transport facilities, the use of cement in constructing poultry houses, &c. A paper by Sir John Green on "Poultry as a Village Industry" was read for him owing to his unavoidable absence.

Medals and certificates were presented on behalf of the College by Sir Daniel Hall, F.R.S., who gave a short address on the importance of poultry keeping and the desirability of improvement in every direction.

The College laying trials were open for general inspection, and there was an interesting and useful exhibition of poultry houses and appliances and of typical utility stock (see photographs). The gathering of visitors was a large one, and it was felt generally that the conference proved a valuable means for the exchange of ideas.

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THE following note has been communicated by Mr. R. R. Blewett, Headmaster of Lanlivery Council School (Cornwall Education Committee):—

Poultry Keeping in an Elementary School in Cornwall.

In the spring of 1920 a chicken feeding experiment was carried out by the upper class children and carefully supervised by the Headmaster of Lanlivery Council School.

The aims of the experiment were primarily educational, and the work involved training in:—

1. Rough woodwork—the sitting box and chicken coop being made from cheap packing cases by the boys who take the course in rough woodwork.

2. The care and treatment of young live stock and close observation of the development of plumage.

3. Weighing and measuring, and arithmetical calculations in fractions, decimals, and percentages.

Every pupil was provided with a sheet of foolscap, which was kept throughout the whole course of the experiment and on which was recorded, in two tables previously ruled, the weight of the flock at weekly stages, and the weekly weights of foods consumed, with valuations. On the completion of the experiment the results were summarised, and the summaries, with a balance sheet, were distributed among the parents of the scholars.

Each week's work concluded on Thursday night. Friday morning's arithmetic lesson was devoted to calculations based on the week's consumption of food and the weight of the chickens. Food remaining in the "7-lb." bags was weighed, recorded and subtracted from the last week's remainders, the difference giving the weight of the food consumed for the week. This was followed by valuations in exact fractions of a penny, calculations in the fraction and percentage of increase in the weight of the chickens, and the total weights and values of foods which went to make that increase. The fact that the objects of the mathematical discussions were running about outside the School made the subject a living interest to the scholars.

Although the aim of the experiment was educational, the figures obtained cannot fail to interest small producers of table poultry. Eleven cross-bred chickens (Indian Game crossed with Golden Wyandotte) were hatched on 4th March, and sold on 20th May, when eleven weeks old, for a total sum of £3 6s. At the time of selling they weighed 28 lb. 14 oz. (average 2 lb. 10 oz.) live weight. The total cost of production was £1 10s. 10½d., made up as follows:—market price of the eggs, 4s. 4½d.; food for mother hen for nine weeks, 2s.; food consumed by the chickens, £1 4s. 6d. The excess of income over expenditure was £1 15s. 1½d.—an average of 3s. 2d. for each bird.

Of the eleven chickens, only three were cockerels, and at the date of sale, after a twelve hours' fast, these weighed 3 lb. 3 oz., 3 lb. 0½ oz., and 3 lb. respectively. With the exception of a

few hours before each early morning meal, the crops of the birds were never empty, from the first meal given 24 hours after hatching until the last meal early in the day on which they were sold. From the second week these birds acquired the habit of "over eating." They were, therefore, never very active, and although they had free range were living under what was practically fattening pen conditions.

The following foods were used:—biscuit meal (chicken grade) at 6d. per lb.; flake oatmeal at 6¾d. per lb.; dry chick feed (consisting of broken maize, wheat, peas and rice, hemp seed, dari, &c.) at 7 lb. for 2s. 6d.; granulated meat at 6d. per lb.; wheat at 24s. per cwt. (damaged); maize at 30 lb. for 6s. 6d. All these were bought in small quantities, the highest prices being paid.

During the first week the average cost of feeding was very slightly under 1d. per bird per week. By the fourth week it had risen to nearly 2¼d. per bird, and kept roughly to this figure until the seventh week, when it mounted to slightly over 3d. per bird. This average remained fairly constant to the end of the experiment, except that on the tenth week the reintroduction of biscuit meal and granulated meat into the diet raised the average cost to nearly 4½d.

One of the problems each week was to ascertain the cost of producing 1 lb. live weight of chicken during the week. At the end of the first week, after reckoning the cost of the eggs for hatching, the food of the mother hen and chicks, the cost of producing 1 lb. live weight was 3s. 10d. By the end of the second week it had fallen to 2s. 11½d.; the third week to 2s. 3½d.; and the fourth to 1s. 11d. By the sixth week the cost had dropped to 1s. 5d. It then fell by slight stages each week until, by the date of sale, the cost of producing 1 lb. live weight was 1s. 0¾d. The birds when sold realised 2s. 3½d. per lb. live weight.

For each of the first four weeks the birds put on an increase of 50 to 60 per cent. on their previous week's weight. In the fifth and sixth week this percentage of increase dropped to 40 per cent. In the seventh week the increase was 27 per cent.; on the tenth it had fallen to 23 per cent. During the first week the cost of putting on 1 lb. live weight was at the rate of 1s. 9d.; and after ten weeks the figure was 9¼d., but during this period feeding was more costly. In the ninth week, when only wheat and maize were fed, the cost of putting on 1 lb. live weight was as low as 6½d. It follows that the "finishing" is a much cheaper process than the production of a 2 lb. bird.

The feeding and the results attained in the eighth and ninth

weeks are interesting. In the eighth week 12¾ lb. of wheat only were consumed. At the end of the week the birds showed an increase in weight of 3¼ lb., or 23 per cent. In the ninth week the food consumed was 6 lb. of wheat and 7 lb. of maize. This produced an increase of 5 lb., or 29 per cent., in the weight of the birds in spite of the fact that the percentage of increase had been falling since the fourth week. This would seem clearly to point to the value of change of food.

Not the least important side of the experiment was the interest it aroused in the immediate neighbourhood.

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Pink Discoloration of Cheese.

THE following note has been communicated to the Ministry by Miss Grace Heather Mason, Lecturer in Agricultural Bacteriology at University College, Reading:—

An investigation has recently been made in the University College, Reading, with a view to ascertaining the cause of pink discoloration of cheese forwarded for examination from a dairy in Yorkshire. The complaint was that the cheese, although normal in appearance when first cut, developed a pink colour very shortly after cutting, the colour spreading over all the cut surfaces, and shading in tone from a light salmon or rose pink to a violet purple. The cheeses were of small size, weighing from 4 lb. to 7 lb., and were made on the Wensleydale system.

It appeared that the affected cheeses had been made during a period of ten days in the summer, and that the coloration was first observed when the cheeses were a month old. The dairy maid who made the cheeses was inclined to believe that the pink coloration was due to the rennet used, the supply of which was obtained from a local chemist, and only lasted during the period these particular cheeses were made. It was not, however, possible to obtain a sample of this particular rennet for this view to be confirmed.

An examination of the affected cheeses showed that freshly cut or broken surfaces were normal in colour at first, but became pink within 12 hours, the colour appearing along the course of fine cracks and veins in the cheese, following the lines of junction of individual pieces of curd. The cheese being of a lightly pressed, spongy texture, this coloration spread rapidly over the surface, leaving the denser portions of curd uncoloured, this giving a marbled or mottled appearance to the cheese. The colour was very marked, and was of a darker pink or violet

tint just under the coat of the cheese. It only penetrated to a depth of about 0.5 mm., so that successive thin layers of tinted portions could be sliced off, leaving a white surface, which in turn became coloured after exposure for a few hours.

Examination of the Cheese.—Examination made of small portions of the coloured cheese showed that large numbers of yeast cells of various shapes, as well as bacteria, were present. Portions of the cheese, both coloured and uncoloured, were then subjected to gelatine and agar, and whey agar tests. It was found that colonies of the usual cheese bacteria of the lactic-acid group, and others, appeared, as well as colonies of yeasts and torula. The yeast was isolated, and grown in liquids and on solid media, in all of which it grew and produced colours of various shades of rose, pink and salmon, the colour deepening as the culture became older.

Trials with the yeast were also made on three small cheeses, weighing from 1-2 lb. each. One cheese (No. 1) was made from milk which was inoculated just before renneting with ground-up portions of the original cheese sent from Yorkshire, and the two other cheeses (Nos. 2 and 3) were made from milk which was inoculated with the pure culture of the pink yeast. No. 1 cheese was made on the Cheddar system, a lactic acid starter being used, and just before renneting a quantity of the original cheese, grated up and mixed with sterilized whey, was added to the milk. The high scald (102°F.) was used as in Cheddar practice. Cheese No. 2 was made in the same manner, except that, instead of the ground-up cheese, a pure culture of the pink yeast grown on bread was added to the milk before renneting.

The cheeses all ripened normally, and were examined daily and cut at about 8 weeks old. In Nos. 1 and 2 no growth of the yeast or pink coloration was noticed, the cheese being somewhat dry and very firm in texture. It was concluded that the dryness and texture and the high scald of the curd had resulted in conditions unsuitable for the growth of the yeast.

On the coat of No. 3 cheese, which was made with a lower scald, resulting in a softer curd, small spots and patches of pink and violet were observed at a very early stage. These followed the cracks and openings in the coat, and even in some places penetrated a short distance into the curd. As the cheese became firmer and dryer, these spots did not spread rapidly, but remained confined to the coat on the clothing of the cheese.

Another cheese, about 2 lb. in weight, was then made on the method of the original cheese more closely. No lactic acid starter was used, and the curd was not scalded above 88°F. The pure culture of the pink yeast in whey was added as usual. The curd was put up loosely, and only very light pressure was applied.

Spots of pink very soon appeared on the outside of the cheese just under the muslin in which it was covered, and were found to contain the yeast cells.

The colour on the coat spread gradually, and turned to a rusty tint. When the cheese was cut at about a month old, the pink colour developed slowly over the cut surface, following the veins and cracks between pieces of curd as in the original sample.

The consistency of the cheese was spongy, open, and not of a satisfactory character from a cheese-maker's point of view, and in this it resembled the original cheeses.

No positive conclusions can be drawn from the experiment, but it would seem that the coloration was due to the yeast.

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Tobacco Growing in England.

A VERY good case can be made out for the cultivation of tobacco on English soil. Recent research and experiment has shown that tobacco cultivation is worth developing. It is said that if 1,000 acres of British soil, unsuitable for the production of wheat, were put under tobacco, the industry would provide profitable employment for 200 families during at least eight months of the year, and would benefit both employer and employee.

Tobacco-growing in this country was begun soon after the plant was first brought from America. It was introduced from Florida, probably in 1565, by Sir John Hawkins, although this gift to the eastern hemisphere is more usually associated with the name of Sir Walter Raleigh. To him its introduction is attributed by Edmund Howes, the chronicler, who says that "Sir Walter Raleigh was the first that brought tobacco into use when all men wondered what it meant." According to John Worledge in his "Systema Agriculturæ" of 1675, there were plantations of many hundreds of acres of tobacco in Gloucestershire, Devonshire, Somersetshire and Oxfordshire. Worledge describes the processes of growing and preparation. "The young plants," he says, "are raised from seed in February or March on a hot bed, and then planted out

in your prepared ground from whence you may expect a very good crop and sometimes two crops in a year. The leaves when gathered are first laid together on heaps for some time and then hanged up (by a thread run through them) in the shade until they are dry and then put up and kept, the longer the better. In this, experience is the best master." This considerable cultivation sufficiently proves the popularity which tobacco had attained during the century immediately following Hawkins's and Raleigh's time.

Notwithstanding its popularity, tobacco had incurred the censure of James I.; and is expressed in his famous "Counterblast to Tobacco." His dislike was shared by Cromwell, who sent troops to tread down the fields, but the Parliamentary soldiers are said to have smoked at the Protector's funeral in order to celebrate their recovered liberty. In Charles II.'s time tobacco flourished at Winchcombe in the Vale of Evesham, but rather than collect excise duty the authorities preferred to abolish the English growth. They were prompted also by certain courtiers who desired a monopoly in the Virginian plantations. Pepys records that it was necessary to send down troops to destroy the tobacco fields, and, as in Ireland at a later date, an industry was deliberately wiped out of existence. By this time it might have developed such proper varieties, methods of cultivation and manufacture as would give it a suitable position in the general market.

In 1831 the Act permitting tobacco to be grown in Scotland and Ireland was repealed, apparently on account of the difficulty of excise supervision. In 1886 and 1887, however, small trial plots were permitted in England, but the results were not encouraging. Tobacco cultivation in this country may be accounted practically non-existent since the early years of the 19th Century. An attempt made in 1883 to revive the industry failed, owing to incomplete knowledge of the best methods of managing the crop. Tobacco is a highly specialised plant requiring intensive and careful cultivation. The leaf intended for smoking must be very carefully blended. It is to be feared that the home industry has been prejudiced by popular distrust of British-grown tobacco, a prejudice that may have arisen from successive failures to establish cultivation in these islands.

In 1907 the Act of 1831 was repealed, and since that time it has been lawful to cultivate tobacco in Ireland. With regard to prices for British tobacco it is interesting to note

that, in 1626, eight ounces cost 5s. and in 1656 two ounces cost 1s. It would appear that in 1620 this country paid Spain £120,000 annually for tobacco. In 1907 the duty on tobacco containing not less than 10 per cent. of water was 3s. per lb. Owing to an extension of the experiments in Ireland, the Chancellor of the Exchequer authorised a payment of 1s. per lb. to be refunded to the producer out of the duty paid on withdrawal from bond. The tobacco on which this rebate could be claimed was limited to the produce of 50 acres. In 1908 the Chancellor of the Exchequer financed a five years' experiment costing £6,000 a year, and this experiment was continued with Treasury assistance on the recommendation of the Development Commission.

The Finance Act of 1909-1910 removed, as far as England was concerned, the ban upon tobacco cultivation, but in 1913 the rebate was withdrawn, and during the Great War the duty gradually rose to 8s. 2d. In 1919 the present Chancellor of the Exchequer gave one-sixth of the duty to Empire production, and a further 2d. excise allowance to the English product.

In 1911 Mr. A. V. Campbell of the Rothamsted Laboratory visited the tobacco-growing centres of Ireland, Holland, Belgium, Germany, France and the United States. His Report confirmed the opinion of the Development Commissioners that the question which requires settlement is not whether saleable tobacco can be grown here, but whether it can be grown at a profit. The Report states that an experiment should not be limited to one district and one kind of soil, but should be made on a fairly large scale, because economic cultivation cannot be carried out on less than 100 acres. Now that tobacco-growing in England has passed the experimental stage, trustworthy data are available as to the best districts, soil, plants to raise, manuring, and methods of curing. The British Tobacco Growers' Society has carried out experiments in many parts of England and has proved that the crop can be grown successfully on the poorer soils of Norfolk, and that this plant can take its place as a farm crop in the ordinary rotation. The Norfolk crops are looking well, and 36 acres are well established in the district of which the Ministry's estate at Methwold is the centre. At Fleet in Hampshire 20 acres are being cultivated.

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Potash Supplies.

DURING the 1919-20 season a considerable quantity of high-grade potash salts was imported from Germany by the Government in exchange for food supplied in the spring of 1919. Alsatian potash was also imported on private account under licence on a large scale. There are now no longer any import restrictions, and merchants are free to import potash without licence from either Germany or Alsace. As the Government is making no official arrangements for its importation from either country, farmers will have to rely for their supplies on the efforts of private firms, and the best way to ensure that they will obtain them is to place their orders early with their usual merchant or co-operative society in order that these may pass on their orders in good time to the importers. Sylvinite, 14-16 per cent. (French kainit), 20-22 and 30-32 per cent. (French potash manure salts), and muriate of potash, can be obtained from Alsace; and 12 per cent. kainit, 20 per cent. and 30 per cent. potash salts, and muriate and sulphate of potash from Germany.

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Milk Recording Societies: An Interesting Competition.

THE development of Milk Recording Societies affords one of the most promising aspects of the agricultural situation. Not only are these Societies doing very good work to improve the quantity and quality of milk and to weed out unthrifty animals in the dairy herd, but they are now beginning to sit up and take notice of their neighbours. They are coming very rightly to the conclusion that they either are or must be better than those neighbours, and in order to put the question of superiority to a test they are establishing dairy herds competitions. Such a competition, open to members of Milk Recording Societies operating under the Ministry of Agriculture in the counties of Surrey, Sussex and Kent, has recently been instituted in connection with the Agricultural Show at Tunbridge Wells. The authorities provided two special classes, and the Committee were fortunate enough to obtain the services as judges of Mr. A. F. Chillingworth and Mr. Robert Hobbs. These gentlemen in the course of their duties were compelled to travel some twelve hundred miles, for there were upwards of one hundred entries, divided into two classes (1) herds of twenty-five cows and under, and (2) herds of twenty-six cows and over. In all, the judges inspected one hundred and one herds. They report that not only was the standard of dairy cattle satisfactory but that they were pleased

to note the number of excellent bulls in use—many of them being full pedigree animals—while inferior stock bulls were quite an exception. The judges very wisely set their faces against herds in which, feeding and attendance being given without regard to cost, milk yields were not produced on an economic basis. They stated definitely that anything like Show condition of cattle should be discouraged. In Class 1 the prize went to a small herd of pedigree dairy Shorthorns, including three or four good non-pedigree foundation cows—the score being 92 points out of a possible 100. In Class 2 the prize went to pedigree Friesians with a score of 96 points; the judges remarked that the cattle were almost entirely home bred, and that the breeding, feeding and general management of the herd testified to the remarkable skill and ability of the owner. The daily average per cow worked out at 3.75 gallons, but out of a herd of 28 cows, of which five were dry, fifteen were milked three times a day.

Mr. H.E. Rudd, Live Stock Officer to the Ministry of Agriculture for the South Eastern Province, was largely responsible for this competition. It may be remarked that the growth of Milk Recording Societies in this area is very satisfactory, the four Societies established having more than doubled their membership during the past year, while there are many applications from prospective members for the next season, which opens on 1st October. It is hoped that there will be another competition next year in connection with the Show at Tunbridge Wells, and that, in addition to another herd competition of the kind just concluded, there will be special classes for individual cows, bulls and calves, open to members of Milk Recording Societies.

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Agricultural Wages Board.

AT a meeting of the Agricultural Wages Board on 12th August (Mr. Collingwood Hope, K.C., C.B.E., presiding), a report was presented from the Administration Committee dealing with the issue of Permits of Exemption by District Wages Committees, the steps taken to secure the enforcement of the Board's Orders since the last meeting of the Board, and the results of the proceedings in six cases of prosecution which had been undertaken since that meeting.

The Board adopted a report presented by Mr. Acland from the Committee on "Cottages," recommending, *inter alia*, the confirmation of determinations by various District Wages Committees of 21 cottages as defective, under the terms of the Board's "Benefits and Advantages" Order, and of the deduc-

tions which the District Committees had made in the cases of the cottages in question from the maximum value at which a cottage may be reckoned in part payment of minimum rates of wages.

The Board considered the objections received to their Proposal of the 9th July, to increase the minimum rates of wages for male agricultural workers of 21 years of age and over throughout England and Wales, together with the reports on the Proposal made by the various District Wages Committees. With certain minor amendments, the Proposal was confirmed as an Order, to come into operation on Monday, the 23rd August. The general effect of the Order is to increase the minimum rates of wages for adult male workers by 4s. per week throughout the country, with the result that the minimum rates for such workers will be 46s. in 19 of the District Wages Committee areas, and will range in the other 20 areas from 46s. 6d. up to 50s. 6d. in the case of Northumberland and Durham. The Order also provides for proportionate increases in the overtime rates.

A motion which was put by Mrs. Toon for the revision of minimum rates for male workers under 21 years of age and for female workers of all ages, was referred to a Special Committee of the Board for consideration.

Full particulars of all Orders made by the Agricultural Wages Board are published in the *Wages Board Gazette*, the yearly subscription for which is 3s. Subscriptions should be sent to the Secretary, Agricultural Wages Board, 80, Pall Mall, London, S.W.1.

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Harvest Wages.

In a note published in the issue of the *Wages Board Gazette* for 2nd August it is stated that during July conferences have taken place in several counties between representatives of employers and employed on the subject of harvest wages. In some counties a satisfactory agreement has been reached, generally embodying a slight increase over last year's rates, but in other cases nothing has been settled. The contention of the employers has generally been that the rate of wages fixed by the Agricultural Wages Board is meant to provide a living wage for the whole year and that as harvest operations are not under present conditions specially onerous no extra remuneration is required. The workers have replied that the minimum rate is insufficient and that harvest wages have always been recognised as part of the yearly income. As in former years, the claim arises chiefly,

but not invariably, in the counties where there is a large proportion of arable land.

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Foot-and-Mouth Disease.

(1) *East Sussex and Kent.* No further outbreaks of the disease were confirmed in this area after those referred to in the August "Journal," p. 420, and the remaining restrictions on the movement of animals were finally withdrawn on the 30th July.

(2) *Norfolk.* The restrictions on the movement of animals in the area scheduled on account of the outbreaks in the neighbourhood of Bowthorpe were withdrawn on the 27th July, no further cases having occurred in that area. Further cases have, however, been confirmed in the Emneth district, bringing the total for the series of outbreaks in Norfolk up to 25. The last case was confirmed on the 18th August at Pentney. All the most recent cases have occurred in a small area lying between Kings Lynn and Swaffham, which is the only part of the country now remaining under restrictions.

THE MODERN COTTAGE: EXPERIMENTS IN PISÉ AT AMESBURY.

CLOUGH WILLIAMS-ELLIS.

CLOSE to the station of Amesbury, on the edge of Salisbury Plain, there is a new hamlet. A year ago the spot was marked with only a few unsubstantial and unlovely shacks and bungalows strung out along the main road, constructions of wood and corrugated iron, the unhome-like homes of small freeholders, poultry farmers and the like.

The Ministry's new ownership of an adjoining 1,000 acres as a Land Settlement Estate for ex-service men, which was ill provided with cottages, at once imposed an obligation to build, and also gave an opportunity for a lead to other progressive landowners in the crucial matter of cottage building. That this opportunity was seized with considerable imagination and energy is well shown by the very interesting little colony that has been brought into being.

Anyone can build cottages—of a sort, and at a price. It was the Ministry's aim to demonstrate two things: (1) that cottages might be substantially erected by the use of local materials and by methods other than those commonly employed; (2) that the most severely practical buildings may be architecturally seemly.

Both of these objects have been attained. The common-sense "workability" of the cottages can be seen from the plans, while a glance at the accompanying illustrations will show that the Ministry's architects have observed the sane traditions of English cottage building. So far as can be ascertained, the current cost of pisé building is but little less than for brickwork, but it was hoped that in these operations pisé would prove considerably cheaper. This hope was not realised, however, as much of the wall building was done in the winter, and, as the work at Amesbury has proved, pisé work must be done in dry weather. If the earth becomes wet "ramming" cannot be carried out properly. At Amesbury the pisé walls had to be covered during wet weather, and as a result labour was wasted and time lost. It is important to lay emphasis on the fact that dry weather is needed for pisé operations to be satisfactorily performed.

It was decided that for the purpose of experiment, and in

order that comparison with other materials could be made, a series of cottages should be erected as follows:—

In Concrete (various systems)	4	cottages
„ Cob	2	„
„ Pisé de terre	6	„
„ Timber (converted Army Huts)	2	„
„ Timber (two-storied elm weatherboarded) ...	2	„

and the remainder in brickwork.

This has been done, and the results are highly instructive to all who have watched the rise of "New Amesbury." The general lay out along a new road is simple, yet well conceived, although the experimental nature of many of the individual houses has necessitated a greater variety of types than is desirable in any ordinary village scheme.

The Department of Industrial and Scientific Research was responsible for the general character of five of the cottages, and in some of the cottages the experimental work has not been restricted to materials and methods, but has also invaded the province of pure architecture. The flat-roofed and box-like "all concrete" house is, for instance, something of an architectural adventure, though its claims to serious consideration from a rural housing point of view have yet to be justified. Of all the cottages, however, the greatest general interest is shown in those built of pisé de terre (earth rammed between movable shutters arranged as a temporary mould).

In this country, pisé building is still regarded as a somewhat startling novelty, a daring innovation to be attempted only with extreme caution and under the most expert supervision. Proper care and direction are of course necessary in this as in every other method of building: the pisé soil must, for instance, have certain characteristics, and the pisé builder must obey certain simple rules of procedure. Though there may be some who claim to be "experts," there is still much to be learnt, and this can only be acquired in the school of experience by the method of trial and error.

So far as this country is concerned, the most experienced authorities on pisé are little in advance of the beginners. It is the united observation and experience of enterprising laymen, working under a variety of conditions, rather than the academic researches of the specialists, that is likely to produce a sound tradition of British pisé building.

Now that the way has been shown, first by Mr. St. Loe Strachey in the "Spectator" pisé cottage at Newlands Corner, and now by the Ministry's more ambitious undertaking at

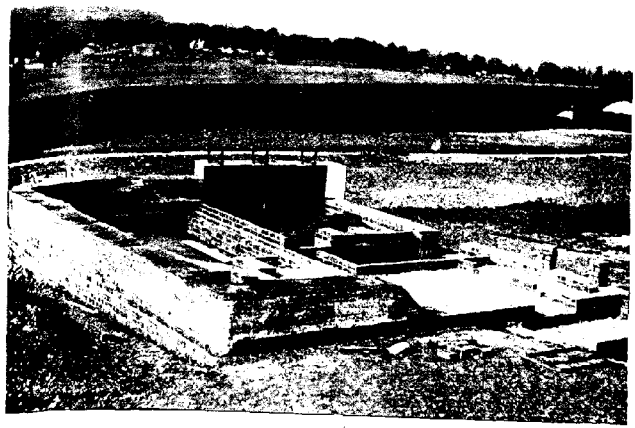

FIG. 1. Pisé de terre walls on brick base. Shuttering in position on wall. (Author's pattern).

FIG. 2.—Chalk Cob. Chalk walling in process of erection. Traditional method. Also showing concrete lintels cast *in situ*.

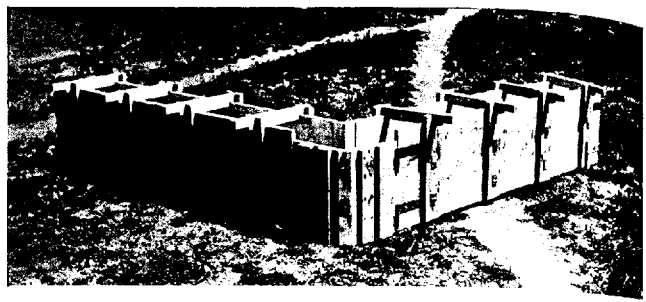

FIG. 3.—Detail of Standard Form for Composition Walling.

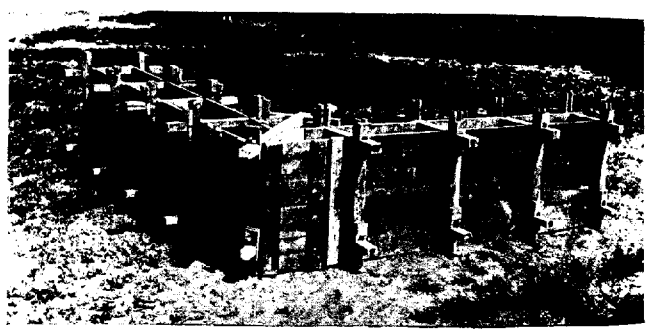

FIG. 4.—Shuttering for pisé de terre, Ministry of Agriculture pattern.

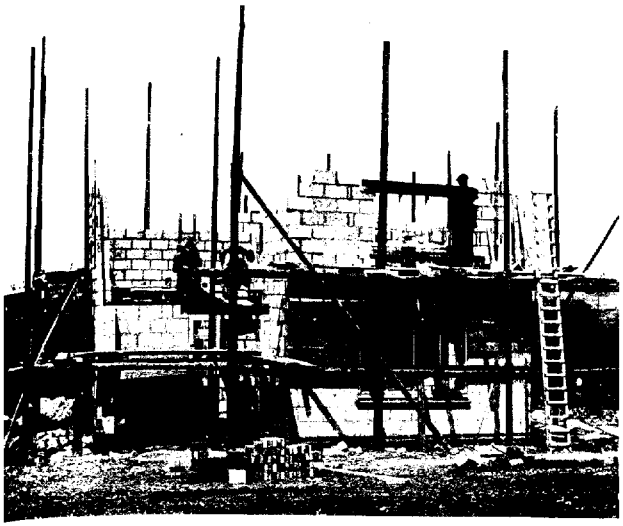

Fig. 5.—Cottage of Chalk and Cement (Dricrete) blocks. Walls in course of erection.

Fig. 6.—Timber Cottages. View showing framing ready for weather boarding and roof tiling.

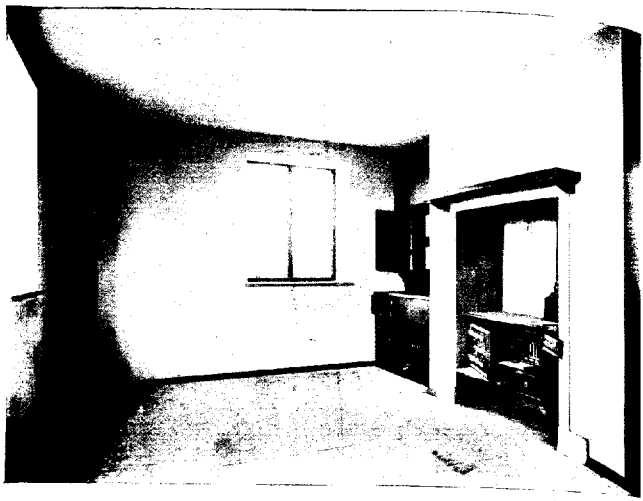

FIG. 7.—Chalk Cob Cottage. Corner of Living Room.

FIG. 8.—Amesbury. General view. Left to right: Cottage in Brick; Cottage of [illegible] Concrete Blocks; pair of Cottages in Brick, whitewashed; and pair of Cottages in Brick

Amesbury, it is hoped that others will profit by the demonstrations. It is satisfactory that a large number of public bodies and private individuals are already engaged on pisé building, but there is still a paralysing tendency to say: "Leave the thing to other folk until we know more about it"—a policy not calculated to advance the system very fast or very far.

From very early beginnings in France, Spain and South America (there are walls in Mexico computed to be over 3,000 years old), but chiefly in the South of Europe, pisé building has spread slowly and sporadically, and numerous continental and transatlantic examples of pisé work exist of great age and excellence. It is strange indeed that the capabilities and merits of the system have remained for so long practically unknown in this country. The various soils and climates must affect its scope to some extent, but enough has already been done both in England and the Colonies to demonstrate the adaptability and wide applicability of pisé building.

Post-war scarcity and high prices have done much to bring the possibilities of pisé to favourable notice, not only in England but in Northern France, Belgium and even Sweden, where handbooks on pisé building have been recently published. The Ministry has also issued an interim report on "lessons learnt" at Amesbury, and the following notes extracted from the report contain some useful information on this method of building:—

> "The conclusions derived from these investigations are set out briefly under the respective heads below. They should not be regarded as final or incapable of modification, for research can still be pursued in many directions: but the data already obtained are sufficiently definite for pisé construction to be embarked upon with satisfactory results.
>
> (A) *Soil.*—It is a mistake to suppose that all earths are suitable for pisé construction; preliminary tests should always be undertaken to determine the suitability of a soil before use. Samples of soil should be tested to ascertain their mechanical strength. The essential qualities of a soil for pisé work may be defined as a firm coherence of the constituent particles when rammed and dried, combined with an absence of excessive shrinkage in the process of drying. A pure clay would satisfy the former condition and pure sand or gravel the latter; yet neither by itself could possibly be used for pisé construction.
>
> The earths ordinarily met with, however, are complex mixtures in which clay and sand are by no means the only constituents; and many of them possess the essential qualities owing to the presence of other ingredients in combination. Calcium carbonate, occurring in chalk, marl, or disintegrated limestone, helps to reduce shrinkage, while detracting little from the cementitious properties of the other ingredients present.

Organic components are bad, being particularly liable to shrinking in drying, and they weaken coherence in the earth as a whole. Top or vegetable soils are, therefore, generally unsuitable.

An all-important point is the amount of water present in the earth at the time of actual use. This factor is so dependent on the composition and character of the soil to be used that a statement of a percentage can only be taken as a very rough guide. In general it will be found that the water present should be between 7 per cent. and 14 per cent. of the weight of the dried earth. In illustration of this factor of water content it may be stated that a clay-gravel-sand mixture gave the best results with as much as 15 per cent. of water; while a chalk loam mixture with 13 per cent. of water shrank excessively on drying, but worked satisfactorily with 7 per cent. The tendency of inexperience is to work with too damp a soil. As long as the rammer will consolidate without pulverising the material it may be assumed to be wet enough. Should it "pug" under the rammer the earth is certainly too wet and will shrink and crack when drying out. A good average sample of the earth should be taken for testing, sufficient to make a number of test blocks; and each block should be made up at a different stage of the earth's drying, so that the most satisfactory water content may be determined by the tests.

The percentage of moisture is most easily found by weighing the samples as made, and again when they are quite dry; the difference in weight, taken as a percentage of the dry weight, giving the figure required. Exact measurements of the length of the sample should also be made, both at the time of consolidation and when dry. The percentage of shrinkage should in no case exceed 2½ per cent. to 3 per cent., and can generally be kept under 2 per cent when the water content is low.

(B) *Shuttering.*—The shuttering required should be capable of resisting the considerable thrust of the ramming; ensuring a true face to the wall; be easily and speedily placed in position and moved as the work proceeds without support from the ground; and be economical in cost. The Ministry's technical officers have devised a set of shuttering rather different from that designed by Mr. Williams-Ellis and used for the Merrow Bungalow. This appears to meet the above requirements, has proved satisfactory in use, and is a pattern which has been adopted by many private owners who are beginning to build in pisé de terre.

(C) *Best Form of Rammer.*—Iron, with a smooth surface, is a more satisfactory material for a rammer than wood. Two forms of rammer, each weighing about 7 lb., are desirable, one flat, the other shaped like a heart, tapering in thickness to the bottom, which should have a blunt edge.

(D) *External Rendering.*—Various materials for rendering have been tried on pieces of experimental wall at Amesbury, but no definite

Fig. 9.—Cottage in Chalk Cob. Completed. Front View.

Fig. 10.—Cottage in Brick. Completed. Front View.

conclusions can yet be given in regard to them. As a result of the experiments it is proposed to try two forms of rendering on the cottages built, one of lime and sand, and the other of a proprietory bituminous material.

(E) *Building in the Winter.*—The cottage erected at Amesbury is proof that, given sufficient protection from severe weather, building in pisé can be carried on during the winter months. The expense of providing screens and tarpaulins, and the labour charges involved in moving them on and off the work as demanded by weather conditions, goes to prove, however, that it is not sound economy to undertake pisé construction during the winter season.

(F) *Cost in Comparison with Brickwork.*—The cost of the first pisé single two-storey cottage at Amesbury, when complete with all finishings and fittings, will not, it is estimated, show an appreciable saving over a similar cottage in brickwork. It must be remembered, however, that this cottage was the basis of all the experimental work; that the brick foundations were carried to an unnecessary height, as is now recognised; that there were difficulties and delays in arriving at a satisfactory form of shuttering; that further delay and expense were incurred by building in the winter; and that the workmen employed had to gain their practical experience on the work.

Work on the pair of two-storey cottages in progress is proceeding smoothly now that the preliminary difficulties have been surmounted; and the careful costings kept in regard to all the building work show that pisé walls, using ordinary building labour, can be constructed at a cost of 15s. per yard super. as against 25s. per yard super. for 11-inch hollow brick walls. These figures are calculated on pisé walls 18 inches thick on lower floor and 14 inches above (average 16 inches), with labour at 1s. 3d. per hour producing 1 foot cube of finished wall per hour as against brickwork costing £56 13s. 4d. per rod. The cost of scaffolding is not taken into account in these figures, but would be less with pisé than brick.

The nature of the foundations is a considerable factor in the ultimate cost of pisé building. It is considered that the pisé work may be begun at 9 inches to 1 foot above ground level; below the level, brick, stone or concrete must be employed."

As regards soil, the material used at Amesbury was approximately a 2 to 1 chalk and earth mixture, both ingredients being immediately available on the site. The inconvenience of chalk is that it absorbs moisture, and unless this property is checked by the use of a good skin of some sort, trouble from frost is likely to be experienced. As, however, such buildings will ordinarily be completed and covered in before winter, the danger is more theoretical than real.

The Newlands Cottage had no more elaborate covering than a

coat of tallow lime-wash, and this has been found quite successful. If a previous application of hot tar (as used on roads) is given, the walls will have an almost impervious skin of quite surprising hardness.

It is interesting to note that in some of the Amesbury examples the chimney-flues are formed by clay pipes embedded in the surrounding pisé.

With regard to rammers and shuttering, there is, undoubtedly, still scope for improvement, and it may be hoped that soon ingenuity and experience will jointly produce a complete pisé-building plant perfectly adapted to suit all the many conditions involved. Some of the outfits recently made have been unduly elaborate and expensive, and, pending the introduction of a more suitable article, the Ministry has acted wisely in adhering to a simple " all-wood " construction that might well be made by any village wheelwright. This is modelled on the same principle as the gear described by Pliny, and is not greatly dissimilar from that used in Spain down to this day. In that country, the writer found it the common practice to mix a proportion of lime with the earth, the percentage varying from 10 to 33. The resultant walls, both new and old, attain an extraordinary hardness and are scarcely distinguishable from cement-concrete. This may well happen in the case of the chalk and earth pisé at Amesbury.

In addition to genuine pisé, cob-work and chalk-concrete have also been given a fair trial at Amesbury, but it is doubtful whether cob building can be profitably revived under present labour conditions, unless in exceptional situations. At Amesbury the cost was discouraging, but the chalk and cement method is distinctly promising.

To gauge properly the success of various building systems employed, and also the scheme as a whole, will require continued observation of the buildings for ten years, and a consideration of the facts which the building accounts and the estates' repair and maintenance records for the intervening decade will reveal. A visit to Amesbury 10 years hence should be exceedingly instructive, and might well lead to a revision of some of the present opinions held.

Even now, however, much has been learnt by those who have superintended the building operations, and also by those who have been able to visit Amesbury. Whatever the results, the Ministry's Amesbury experiment has undoubtedly a special and abiding interest to all connected with rural housing, or concerned in improving the amenities of rural England.

GRASS AND CLOVER SEED GROWING IN GREAT BRITAIN.

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Chief Seed Analyst, Ministry of Agriculture's Seed Testing Station.

WHILE the British plant breeding and seed growing industries remain in their present state of development, it is not to be denied that in a few cases foreign seed is preferable to our own. It has, for instance, been shown with sufficient clearness, by Gilchrist's Cockle Park trials, that at least in the north-east of England, New Zealand cocksfoot is better suited for long leys than the various cocksfoots originating at home, since the New Zealand strain ripens later, and is therefore not so over-grown and coarse by the time harvest is reached. Further, there are undoubted instances where, under given conditions, and for given purposes, Chilian Red Clover is more suitable than English, and others where French Sainfoin is more profitable than the home-grown product. If these cases are examined, it is generally found that the qualities which give the foreign samples their superiority are such as could very well be made prominent in our own strains if careful selection were exercised—that is to say, they are not *new* properties which would need to be introduced, but properties which need *developing*. The available evidence goes to show that such improvements are not only possible, but would probably offer comparatively little difficulty. For example in the case of the Cocksfoot cited above, it would appear that by selection for lateness, British Cocksfoot could be brought to a condition quite equal to the New Zealand seed recently in demand. A further consideration (apart from the benefit to national credit) also arises in that we may not always be able to purchase seed from those particular world localities which produce strains suitable for our requirements. The same instance may again be cited—it has recently been extremely difficult, and often quite impossible, to obtain New Zealand grown Cocksfoot.

In the majority of cases, however, there is no doubt that farmers have every reason to prefer British seed. But the supply of British seed in the case of many species is not nearly sufficient to meet the demand. Taking the commonly used clovers, for instance, over the years from 1914-1918, the quantity

of foreign seed imported was probably about half as much again as the quantity grown in Britain.

It seems highly desirable, therefore, in view of the general superiority of English seeds over the foreign strains for use in this country, to extend the growing of agricultural crops for seed, in suitable districts.

With this question in view, and also that of the improvement of certain species by selection and breeding, a survey* of the seed growing districts in England, Scotland† and Wales was undertaken in 1919 with the object of ascertaining to what extent the various species were seeded in Great Britain, which districts had been found especially suitable for particular species, what were the climatic and soil conditions under which seed of the various species was produced, and to what extent and in which districts seed growing could be economically extended. The remarks which here follow present an outline of the information obtained and opinions formed during the course of the survey.

General View of the Position.—If a line be drawn from the north of the Severn mouth to the Wash, the principal districts which produce agricultural seeds will lie to the south of that line: a few detached counties and districts are of importance in the area north of the line, the most notable being Hereford, eastern Montgomery, the Vale of Clwyd, Ayrshire, and the carses of Stirlingshire and Perthshire. The comparison of a map so marked with a meteorological map shows that no relation can be traced between climatic conditions as regards rainfall and sunshine and the distribution of seed-growing areas. If comparison be made, on the other hand, with geological and drift maps, the connection between the seed-growing industry and the distribution of soils is fairly evident. In general, the heavy lands (largely those derived from boulder clay drift) are used for Red Clover seed growing; White is produced on heavy and medium soils; and Trefoil and Sainfoin are most strongly developed in calcareous districts, although both these stray on to the clayey land where the latter contains chalk. Grass seeds in England are only produced in quantity in the fen districts; smaller amounts are produced in other places as a by-product in the harvesting of clovers. The Scottish counties named produce Ryegrass and Timothy.

* A detailed report of this survey will be published by the Ministry later.

† The surveyor was enabled to visit the Scottish seed-growing districts by the courtesy of the Board of Agriculture for Scotland.

Red Clover.—At present the bulk of English Red Clover seed is produced in Essex, Suffolk, Norfolk, Bedford, Hertford, Kent, Sussex, Hampshire, Wiltshire, Dorset, Cornwall, Gloucester, Oxford, Hereford, Montgomery and Denbigh. The proportion of the county occupied by the seed crops varies greatly, however, and while, for instance, nearly every farmer in Essex north of Brentwood produces some seed in a good season, in Cornwall none is grown except in one very restricted area about Wadebridge.

To a great extent the more important Red Clover growing districts produce both Broad Red and Late Flowering Red (Single Cut Cow-grass); the two are so similar in morphology and as regards requirements, that this is to be expected. The amount of Broad Red produced in the United Kingdom appears, however, to be about five times that of Late Flowering Red. There is at present an increase in demand for home-grown seed of true Single Cut Cow-grass, and in some districts a regrettable confusion between the characters and qualities of Single Cut Cow-grass and those of ordinary Broad Red Clover, an undesirable state of affairs in view of the peculiar advantages possessed by each variety for special purposes. True Single Cut Cow-grass is a variety, the production of which could with advantage be materially increased. In the first place the increasing demand, mentioned above, would be better met by home-grown seed than by foreign. Secondly, in some of the heavy clover producing districts the industry suffers under the scourge of clover sickness, sometimes fungoid, sometimes due to eelworms. The fungoid type seems much more frequent than the eelworm type, and it is well established that true Single Cut Cow-grass is much less attacked by the disease than is Broad Red. Single Cut Cow-grass might very well be grown, therefore, in those districts where clover sickness inhibits the growth of Broad Red. Again, many growers in other areas are obliged to limit their Broad Red crops to one in every two rotations, and to insert some other crop, not used for seed, in the alternate cycles. This difficulty could be eliminated by the use of Single Cut Cow-grass alternately with Broad Red.

It should be noted by intending growers of Single Cut Cow-grass, that to obtain true and genuine seed in the first instance is of immense importance, and as the supply is none too plentiful it is not always easy to do so.

In this connection arises the question of *acclimatisation*. It is held by some men of experience and authority that strains

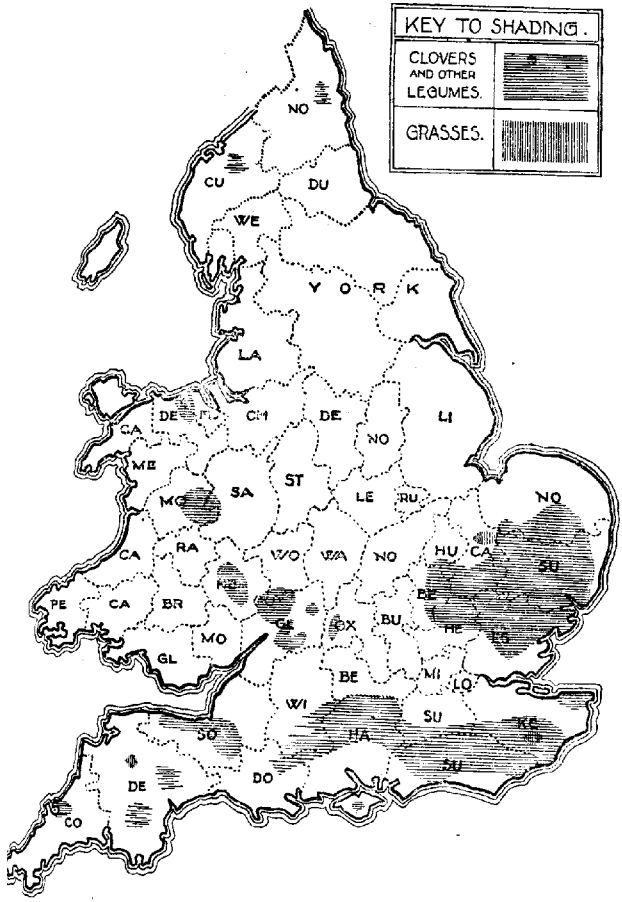
which have become "acclimatised" to a given district by continued growth over a large number of years in that district, are much more valuable for use in that locality than "imported" seed (even though brought from another part of the same country). This theory calls for consideration by seed growers and seed users, for even though it may not yet have met with general acceptance, there is considerable practical evidence supporting it, in more than one part of the country.

This matter also leads naturally to a consideration of the further question regarding the special value of indigenous strains which at the very least are certainly guaranteed to be thoroughly acclimatised in their own districts. It is strongly urged by some authorities, and it is the firm belief of the writer, that most valuable strains, both of grasses and legumes for use in Britain, could be raised by the collection and selection of wild British plants, and it has been definitely shown by practical trials in more than one case that this is so. Here, therefore, is another question which must be borne in mind in discussing the possibilities of British seed production.

The belief in the value of acclimatisation (though it may not have been recognised as such) has led in most of the heavy clover producing areas to the establishment of privately owned strains of clovers, which in many cases have been grown annually on the same farms for a great number of years, and which locally enjoy high reputations. Very few instances can be found where a definite practice of selection has been made in the establishment of these strains, although in some cases a very useful automatic selection has taken place, as for instance, in the case of certain sainfoins discussed below. The great danger connected with the continued growing of the same stock on the same farm lies in the risk of it becoming increasingly dirty. This need not happen, of course, if the grower is in a position to instal efficient cleaning machinery for his own use. Where such an installation is not available, *each season's produce should be sent to a merchant to be thoroughly cleaned before re-sowing.* The practice of selling the head seed each year and sowing tails to perpetuate the stock is to be most strongly condemned.

Details of cultural practice in the various parts of the country where Red Clovers are grown for seed will be given in the Report of the survey referred to above (footnote, p. 536).

The average crop of Red Clover seed in Great Britain is about four bushels (about 260 lb.) per acre.



Map showing the areas in England and Wales which produce grass and clover seeds.

Alsike.—The amount of Alsike seed grown in Britain is very small, totalling only a small fraction of the amount purchased from abroad. Such as is grown appears to be produced mainly in East Anglia. A number of growers seem to have attempted an Alsike seed crop once, and never to have repeated the experiment. It may be that such cases gave poor results owing to the accident of bad season, or there are possibly factors connected with our climate and soil conditions which render an Alsike seed crop especially hazardous. Such factors, if they exist, are at any rate not obvious from a comparison of our conditions with those of, say, the North European countries where Alsike seed is produced. There would seem to be room for further trials of Alsike as a seed crop in our clover growing counties, and possibly also in other counties rather more northerly than those at present producing clover seed, before any definite decision as to the advisability of extending the industry is arrived at.

Good average crops in East Anglia have produced about 4 bushels of seed per acre.

White Clovers.—Most of our White Dutch Clover is produced in the eastern, southern, and south-central counties. In those districts the White Clover areas follow in a general way the outlines of those indicated for Red Clovers, except perhaps that the counties concerned produce White more regularly than Red on their lighter soils. White clovers possess the advantage over Broad Red of being much less susceptible to fungoid sickness, and herein lies a further possibility of increasing the clover output from suitable counties without running the risk of augmenting the already rife malady—rather, indeed with the prospect of eliminating it.

The chief point of interest with regard to White Clover growing is the extraordinary situation respecting Wild White Clover. It is inexplicable that, while the demand for Wild White Clover is so great, and while the price of the seed is so high, comparatively few farmers and very few districts have undertaken its production. Two factors seem largely concerned with the anomaly. In the first place, there are large areas—notably in South-west England and North Wales—where Wild White Clover grows abundantly in the natural herbage, and there is no necessity to sow it. It seems probable that because of this its immense value to husbandmen in less fortunate districts is not appreciated, and so no attempt is made to harvest it. The objection to districts thus geographically placed immediately presents itself, that the rainfall will be so high as to offer great difficulty

to harvesting operations. Wild White Clover, however, is always a light crop compared with Red, and farmers in the districts mentioned can and do successfully harvest the latter. Secondly, there is the objection, strongly felt in some districts, against any Wild White Clover other than that harvested directly from genuine old pasture. Such evidence as is available tends to show that Wild White once grown on arable land is quite as valuable as genuine old pasture seed. In spite of this there are many districts where the once grown product is persistently refused, and in view of this objection, counties eminently suitable for the production of Wild White from arable land have no encouragement to undertake it.

The title "Wild White from old pasture" is frequently assumed to be a guarantee that the field which produced the seed has been down to pasture over a large number of years. To many readers, the phrase probably conjures up a vision of pasture laid down something over twenty years ago, but one may easily be misled in this matter. Pastures are not infrequently sown down for the definite purpose of producing "Wild White from old pasture," and the product so styled is not, therefore, by any means always taken from plants of great age. It not infrequently happens that a purchaser buys Wild White once grown under the name of Wild White from old pasture, the only difference being that it has been once grown in a pasture mixture instead of on arable land. It is not suggested that the seed is any the less valuable for this—quite the contrary. The intention is simply to point out that the title "Wild White from old pasture" does not always guarantee that which it popularly suggests. Be it observed, however, that we do not yet know through how many generations a strain of Wild White Clover must be grown before it begins to lose its wild characters, so that although the number is probably much greater than one or two or even a dozen, in the present state of our knowledge care should be taken that Wild White once grown is the daughter of genuinely wild parents, and not the granddaughter or any more distant descendant.

The Dutch White Clover produced at home is in considerable excess of the amount imported from abroad, so that the need for augmenting the home production of this variety is not so marked as in some other cases. As regards the necessity of vastly increasing the output of British *Wild* White, however, there can be no question. It seems probable that Wild White can be

successfully grown upon a great diversity of soils, and there are one or two districts which excel in the great luxuriance and profusion of Wild White among the natural wild herbage. Particular mention may be made of the south-western country, including Cornwall, Devon and parts of Somerset and Dorset, and the Valley of the River Clwyd in Denbighshire and Flintshire.

There is evidence to show that even among strains of Wild White which are genuinely wild, acclimatisation to a given district has some effect on the strain. At present, however, the demand so far outweighs the supply that Wild White should be grown wherever conditions allow, and in as large quantities as possible; but intending growers should note that the crop is a very risky one, and that threshing and cleaning is an arduous and expensive business, so that very small quantities, although there may be a ready sale for them, may not always be profitable.

Average crops of Wild White in England vary considerably according to locality and season. Genuine old pasture produces up to three-quarters of a bushel (about 50 lb.) in a general way, and an arable crop will give, perhaps, a bushel and a half. Details as to cultivation and harvesting will be given in the Report referred to on p. 536.

Crimson Clover.—The demand for Crimson Clover in this country is small compared with the call for, say, Red or White, and its use is mainly confined to the southern half of the country. We produce at home considerably more seed than we import, but, generally, no individual grower seeds a large area. This is easily understood in view of the very risk nature of the seed crop. The ripened heads hold water well, and the attachment of the ripe pods is so brittle that shattering is very easy, so that from one or both of these causes the whole of a crop may readily be lost. It is common in the Crimson growing districts (East Anglia) for farmers to grow a breadth each year, using the major part of it as green fodder, and just seeding sufficient for their own use next season. An average crop yields about one sack of seed (about 260 lb.) per acre.

Lucerne.—English-grown Lucerne constitutes a small fraction only of our annual Lucerne consumption. There seems to be room for a good deal of experimental work in the production of the seed in this country. One of the principal factors bearing on permanence of Lucerne is longitude; while some

varieties will do very well in the eastern parts of England, their success is less and less marked as one moves westwards, until a line is reached about the middle of the country beyond which the crop is not profitable. Nevertheless, cases have been noted in counties considerably further west than this line, where the ordinary seed is not worth sowing, but where certain individual plants from a crop, if sown, will last up to twelve or fifteen years, while the rest disappear in the first two or three seasons. This suggests that a strain might with comparative ease be selected from among the ordinary Lucernes, which would stand quite well, even in the more western counties. In view of the valuable properties of good Lucerne, such selection ought to prove well worth while.

Sainfoin, Trefoil and Kidney Vetch.—These crops are usually to be found, as might be expected, in the chalky districts. The largest seed-producing areas are the chalky districts of the eastern counties, the northern part of Hampshire, and Oolitic areas in the Cotswold region.

The case of Sainfoin furnishes a very interesting and instructive object lesson in the matter of automatic selection. In Hampshire, long Sainfoin leys are employed, which frequently remain down for a dozen years or so; for such leys it is obviously necessary that a long-lived strain be employed. It is found that the sainfoins seeded in East Anglia will not stand in these leys for anything like as many years as Hampshire-grown Sainfoin. Here is a case, commonly ascribed to acclimatisation, the true explanation of which would seem to be that, whereas in East Anglia seed is taken from a Sainfoin crop at an early age (often in its second year), in Hampshire the crop is not harvested for seed until it has been down for some six or more years. Since short-lived strains commonly produce more seed per plant per annum than their longer-lived relatives, the effect in the one case will be to reduce the longevity of the strain by early harvesting through a succession of generations, and in the other case to enhance the permanence of the strain by ensuring that seed in each generation is only taken from the longest lived plants. These two practices, having been in operation for many years, have thus naturally resulted in Hampshire Sainfoin being a much more permanent strain than East Anglian Sainfoin.

Although in this particular case the effect has to a large extent been wrought involuntarily, there is no reason why the same system should not be employed with a number of other

crops, and probably very valuable strains could in many cases be obtained in this way.

Average crops of common Sainfoin produce about 8 or 9 sacks (about 800 or 900 lb.) of seed per acre, and of Giant Sainfoin, when seed is taken from the second cut only, as in East Anglia, about 5 or 6 sacks. Trefoil yields some 5 or 6 quarters of seed in cosh, though the crop is very variable in different districts.

Grasses.—Taken as a whole a much greater proportion of the grass seed which we use annually is produced at home, than is the case with clovers. Italian and Perennial ryegrasses and Timothy are the only three grasses produced on a large scale in Great Britain. Crested Dogstail is grown to a considerable extent in Great Britain, but Ireland is a much larger grower. In addition to these, small quantities of Cocksfoot, Meadow Foxtail, Sweet Vernal, Tall Oatgrass, Golden Oatgrass, Meadow Fescue and Rough Stalked Meadow Grass are grown.

Ryegrass.—As far as England and Wales are concerned, ryegrasses are grown to a large extent in one district only, the fens of north-eastern Cambridgeshire. The produce of this area is very largely Italian Ryegrass; Perennial is mainly grown in Ayrshire and in the carses in the neighbourhood of Stirlingshire.

A certain amount of "Annual" Ryegrass is grown in Ayrshire for use in the same district, but the grass does not appear to be sown in other parts of the country to any extent. This variety is not *Lolium westerwoldicum*. Its seed closely resembles that of Perennial Ryegrass, but is rather long and parallel-sided, compared with a typical sample of the latter. It appears to have been selected from ordinary Perennial, and is commonly used in a mixture with Timothy, the idea being that the ryegrass may be seeded in the first year and then die out, the Timothy being harvested in succeeding years. Its strictly annual character seems, however, somewhat doubtful.

A little Perennial Ryegrass used to be seeded in the Okehampton district of Devonshire, but the strain has now almost died out. As far as can be gathered it seems to have been a valuable ryegrass, and its revival might well be worth while. Ryegrass is seeded on a small scale under the name of Hampshire bents in the north and east of that county, and also in the Ringwood district, but the industry does not seem so general as formerly.

Ryegrass needs to be well ripened, and harvesting, therefore,

is not always an easy matter. There is an adage in Ayrshire to the effect that "the more you lose the more you get," that is to say, the crop must stand until the seed is ready to drop from the straw without much shaking. In a wet season in the fens, it is sometimes necessary to thresh the stooks by hand in the field when it is impossible to get them dry enough to stack. In Ayrshire it is not usual to stack Ryegrass at all, but to thresh straight from the rickles (pikes). An average crop from the first cut of a first year's growth of Italian in the fens is about 8 bags of 140 lb. each, or rather more. The autumn cut will yield some further 8 bags. In Scotland an average crop of Perennial is expected to yield about 8 cwt. of seed per acre.

It is desirable that a uniform system of buying and selling ryegrass should be set up. The present system where some sales are made by weight and others by volume, is not always conducive to high bushel weight.

Timothy.—By far the major part of our Timothy seed is Scottish; the carses of Gowrie and Stirling produce large quantities, and Ayrshire proportionally rather less. One of the main factors in cultivating Timothy for seed is cleanliness; a good clean Timothy ley may be kept down as long as 25 years, but unless the land is very clean to begin with and good seasons follow, this is not often possible. In bad circumstances crops may have to be ploughed out at the end of half a dozen years. Timothy is a rank crop which calls for liberal manuring; if a crop is well treated in this respect, seed may be taken from it every year after the first. Timothy is rather earlier to harvest in the east of Scotland than in the west, probably on account of the lower rainfall. A clean crop may be cut with a binder. Stacks are made in some cases but not in all, and an acre should yield some 4 cwt. of seed from an average crop. On stronger land 5 cwt. may fairly readily be obtained.

Crested Dogstail.—As a constituent of permanent mixtures Crested Dogstail has latterly come into rather more favour than it enjoyed a few years ago, and it seems likely that the demand for it will increase, at any rate, for a short while. At present very little Dogstail is grown in Great Britain, the crops which are produced being frequently a by-product from another crop. The Kentish Wild White Clover pastures, for instance, produce a certain amount of Dogstail mixed with the Wild White, and it is a common practice to separate the grass when threshed from the clover, and to re-dress and market it. There are no districts of

note where Crested Dogstail is grown alone as a definite crop. In former years the grass used to be cultivated in Hampshire for the straw which was used in the manufacture of straw bonnets, but since the latter have gone out of fashion the Dogstail industry has been dropped. It is possible that its revival as a seed crop would be worth trial.

Cocksfoot.—Cocksfoot is one of the outstanding instances among grasses where there seem to be great possibilities for the development of English-grown strains. At present British-grown Cocksfoot only represents a very small fraction of our cocksfoot consumption, and as was pointed out at the beginning of this article, cocksfoots are very variable in character and quality, a fact which suggests that it ought not to be difficult to select strains especially suitable to Britain from among our indigenous plants. There is a remarkable growth of Wild Cocksfoot each year on the waysides and waste places of several districts, the most noteworthy being the south and south-western counties of England, where it is associated sometimes with Tall Oatgrass, and sometimes with Sweet Vernal. It seems probable that both Cocksfoot and Tall Oatgrass from such districts would repay cultivation and selection. In the case of Tall Oatgrass, however, very great care must be taken that the *bulbous* variety, which is largely represented among the wayside flora, be avoided in making the selection. The introduction of this weed into arable land would only spell disaster.

Failing selection from wild plants, the remarkably strong growth of these species in the wild state suggests that the cultivation of them in these districts would be a paying proposition, even though purchased seed were used.

The demand for Sweet Vernal is so small and its value in many cases so doubtful that it is a question whether the cultivation of the species in its present condition is to be recommended, but to judge from the character presented by some wild sweet vernals it seems highly probable that here again careful selection could provide a strain suitable for this country which would produce much more herbage than do our present vernals, in which case, in view of its earliness, the species would be considerably enhanced in value.

Meadow Fescue.—A few odd crops of Meadow and Tall Fescues are seeded in scattered districts, but there is no special area denitely committed to the production of them. *Festuca pratensis* appears to be a species which does very well in districts that suit

it, but it is not by any means universally successful. Since, however, we use much more seed than we grow, it offers perhaps the best case for trials, among the remaining grasses.

Other Grasses.—Meadow Foxtail, Golden Oatgrass and Rough Stalked Meadow Grass are grown to a very small extent in scattered districts, but all three together cover a very small area. Among them Meadow Foxtail seems to be in the greatest demand, and therefore perhaps offers the best chances for experiment, while the demand for Rough Stalked Meadow Grass, although small, is on the increase.

HOW TO PROTECT WHEAT: SOME NOTES ON FUNGUS PESTS.

IN a time of wheat shortage throughout the world, every quarter grown in Britain is a national asset. There are two methods of augmenting the supply:—(1) by enlarging the area under cultivation, and (2) by increasing the yield per acre. The importance of the former cannot be urged too strongly. It is paramount. The possibilities of the latter are perhaps not always fully realised. Cultivation, fertilisers, and varieties materially affect the yield, and there is another factor equally powerful in making for increased supplies, namely, the control of fungus diseases.

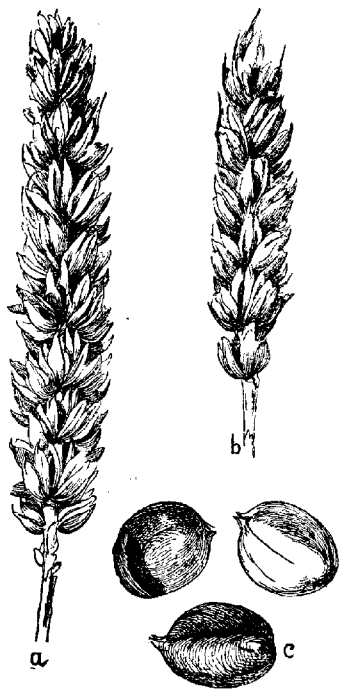
Exact figures are not available, but it is a lamentable fact that through the insidious workings of rusts and smuts alone several hundred thousand quarters of British wheat are lost annually. Each season parasitic fungi quietly but persistently steal a portion of the crop. They exact a toll on the nation's wealth and impose, as it were, a tax on the farmer's income. Whether he realises it or not, they reduce the farmer's income and rob him of his profits. This "fungus tax," however, should be contested, for the full amount need never be paid. A large "abatement" can always be obtained, and in some cases complete "exemption." Thus, by adopting proper measures an attack of Bunt or Stinking Smut can be entirely prevented, and the amount of Yellow and Black Rust largely reduced.

Though the diseases of wheat are very numerous, the most serious in this country at the present time are perhaps the three referred to above. Reliable preventive measures, already known to many farmers, have been found, and it is the object of this article to bring them to wider notice. If the advice here offered is taken, wastage of the 1921 crop through their ravages will be reduced to a minimum. As a result the farmer will reap a better harvest and will be able to present an additional contribution to the much needed general wheat supply.

Bunt or Stinking Smut.—In Bunt the ear appears normal, but the grains when broken are found to contain merely a mass of black spores which smells like putrid fish. The wheat plants are infected in the seedling stage, but for a long time hold their

own and develop normally. Finally, however, the fungus wins, completely destroying every grain in the ear and producing a mass of spores wherewith to propagate itself next season.

From reports furnished to the Ministry's Plant Disease Survey Office it would appear that in 1919 Bunt was more prevalent than usual, especially in the North and West Midlands. Particularly bad cases were also noted in Worcestershire and



a and *b*. Bunted ears. *c*. Bunted grain, containing black mass of bunt spores (magnified about four times).

Buckinghamshire; "Browick" was severely attacked in Herefordshire, "Victor" in Somerset and Devonshire, whilst "April Bearded," so extensively grown in the late districts of the West Midlands, Monmouth and South Wales, was very generally badly bunted.

Bunt may be prevented by "pickling" or treating the seed with a fungicide. In most of the best wheat districts proper pickling is regularly practised, and the crop, as a result, is clean. Where Bunt is present, inquiry has invariably shown that either no treatment was given or, if given, ineffective substances were

employed. The Ministry recommends *one or other of two substances only*, viz., copper sulphate (blue-stone) and formaldehyde. Other substances are commonly used, but these are for the most part useless. It should also be noted particularly that no substance has been discovered which affords protection from both birds and Bunt.

The secret of success in Bunt control lies in:—(1) the use of proper chemicals; (2) care in the method of pickling; and (3) the prevention of subsequent contamination by the admixture of untreated seed. It has been repeatedly proved that if these points are attended to complete elimination of the disease, even under farm conditions, can be obtained.

Treatment.—Even if there is no evidence that Bunt is present all doubtful seed should be pickled. For treatment with blue-stone the pure copper sulphate should be obtained, and a solution made at the rate of 1 lb. of copper sulphate to 10 gallons of water. The seed may either be thoroughly wetted with the solution on the barn floor, or steeped in a barrel for one to two hours, and afterwards spread out to dry. The formaldehyde method is, if anything, more satisfactory. With this substance 1 pint of commercial formalin (=40 per cent. solution of formaldehyde) is diluted with 20 gallons of water. (Smaller quantities may be prepared at the rate of two teaspoonfuls of formalin to 1 gallon of water.) The pickling solution should be thoroughly stirred before using, and should be applied to the grain in the same manner as the copper sulphate. If the steeping method is employed 20 minutes is sufficient, and the grain should be spread out afterwards to dry. (For full details see Leaflet No. 92.)

Yellow Rust. — The fungus causing Yellow Rust (*Puccinia glumarum*) is by far the most prevalent of all the wheat-attacking fungi in Britain. It is present to a varying extent every season even in the best wheat-growing areas, and in the case of most varieties probably occurs in every field. The disease is recognised by the innumerable, bright yellow spots or "sori" on the leaves. These sori contain a golden powder, the spores of the fungus which spread the disease. Sometimes the lower leaves only are attacked, but the upper ones often suffer also, the fungus spreading further to the ears and even to the grains. Owing to Yellow Rust being a "leaf rust" its effects are not so striking or disastrous as those of the "Black Rust," which is a "stem rust," and hence the damage inflicted is not always realised. The loss in the aggregate, how-

ever, is startling. Professor Biffen, in his essay on "Systematised Plant Breeding,"* writes with regard to this disease "what this (toll) amounts to on the average it is impossible to say at all definitely, but an estimate of from 5 to 10 per cent. is probably not very wide of the real figures." Applying even the lower figure to the year 1919, when 2,370,367 acres were under wheat, the amount lost by Yellow Rust (at an average of 4 quarters per acre) would be over 450,000 quarters. An allowance, however, must be made for resistant varieties.

The fact which every farmer should realise is that *this loss of crop is largely preventable.* There exist some good wheats which are very suitable for use in this country and are highly resistant to Yellow Rust. By the growing of these wheats the fungus is outwitted and the crop benefits in proportion. The three wheats resistant to Yellow Rust are "Little Joss," "Yeoman," and "Swedish Iron," the first two being raised by Professor Biffen at Cambridge. Unlike the susceptibility of potatoes to Wart Disease, where certain kinds are absolutely immune, these wheats sometimes show, specially early in the season, traces of Rust. They are, however, highly resistant, and always stand out in striking contrast to other sorts. No specially resistant spring wheat has yet been raised. In all districts where winter wheat is grown and Yellow Rust is prevalent, one or other of these varieties should be tried. Notes on their characters and their suitability for different areas are given below. Further advice may be obtained from the local Agricultural College.

"*Little Joss.*"—An excellent all round, red wheat of good quality; it tillers freely and matures early. It is particularly suitable for light and poor soils, late districts and exposed situations, but is not good for land which is cold and wet in winter.

"*Yeoman*" is a new wheat with short, stiff straw. It possesses high-yielding and first-class milling properties, and can be grown on almost all classes of soil. It does extremely well south of the Thames.

"*Swedish Iron*" is a stiff-strawed, large-grained wheat suited for good land in a high state of cultivation. It does well in the north and cooler parts of the country.

Black Rust.—*Puccinia graminis*, the Black Rust fungus, is without doubt by far the most serious of all wheat parasites. This is this fungus which causes the devastating epidemics in India, Australia, and America, and it is, in fact, liable to occur in epidemic form in any country where it exists. As an example

* "Science and the Nation," Cambridge, 1917.

of the damage this minute organism can bring about it may be noted that in 1916 it was responsible for the loss of 100 million bushels in the three prairie provinces of Canada, and in the United States of over 200 million bushels in North and South Dakota, Montana, and Minnesota alone. Fortunately for Britain, Black Rust of wheat is exceedingly rare in our islands, and has been regarded as practically non-existent. During the past few years, however, its occurrence in a certain district in Pembrokeshire has been observed, and inquiry has shown that the attack is of several years' standing and extends over a wider area than was at first thought. A special survey was commenced last autumn, conducted jointly by the Agricultural Department of the University College at Aberystwyth and the Ministry of Agriculture. From the results obtained by the Survey it appears that Black Rust in severe form now occurs annually over the whole of Pembrokeshire, Carmarthenshire and South Cardiganshire. The disease is locally termed "blast," and its appearance is often considered to be due to bad weather. The damage caused has been very severe. The fungus particularly attacks the straw, which it often completely cripples, and on which the black streaks of spore-masses develop. Losses of over 50 per cent. are frequent, and in some cases the entire crop is ruined and is not worth threshing. Not a few farmers in South Pembrokeshire have entirely abandoned wheat growing.

Although south-west Wales is mountainous and not a wheat growing country, the amount grown is highly commendable and is a material contribution to the nation's supply. The figures for 1919 are:—Cardiganshire, 7,208 acres; Carmarthenshire, 11,421 acres; Pembrokeshire, 3,484 acres. If proper measures be taken the yield from these 22,000 acres may probably be doubled.

The Barberry Menace.—Unlike Yellow Rust, Black Rust has a second host-plant, namely, the common Barberry, on which it occurs very widely. The injurious effect of Barberry on wheat has been known to farmers for upwards of two centuries. They affirmed, in spite of opposition, that it led to attacks of Black Rust, and subsequent investigation showed that they were right, the scientific proof and explanation being obtained many years later. The survey in Wales shows that the Barberry is generally and plentifully distributed in the three counties mentioned, occurring around the homestead and in the hedges. The fungus is found on the Barberry leaves in the spring in the form known as the "cluster-cup." Stretches of Barberry 100 yards long have been noted in lanes and on the roadside, sometimes covered

with the "cluster-cups" of Black Rust, from which spores were being discharged and blown in all directions. In another striking case a piece of Barberry hedge adjoined a wheat field, and the golden spores were being rained from the cluster-cups over very promising wheat. Isolated bushes of Barberry occur in other parts of England and Wales, but not to anything like the same extent.* The explanation of these severe attacks of Black Rust in the south-west of Wales is therefore clear; they are largely, if not entirely, due to the presence of Barberry. A full and illustrated account of this outbreak will be published shortly in the Ministry's *Journal*, but the present opportunity is taken of pointing out the danger so that every effort may be made to exterminate the shrub.

Although other factors may be concerned, there can be no question that the Barberry is the offender. The same shrub accounts for the enormous losses in the United States and Canada. A native of Europe and Asia, it has been planted in gardens in America and is now found wild along streams, rivers and roadsides. During the past few years the clearest evidence against the Barberry has been obtained in the Northern States. Each bush may commence a local outbreak, which serves as a centre from which the disease may, by means of its summer spores, spread for many miles. With a view to preserving the wheat crop an energetic Barberry campaign is now being carried out in Canada and in the United States. Similar campaigns have taken place in Europe. In Denmark, for instance, owing to the ravages of Black Rust, a law was passed in 1903 making the destruction of Barberry compulsory. From that date the disease commenced to die out, and is now practically non-existent.

No variety of wheat, suitable for use in Wales, can be recommended at present as immune to Black Rust. With a view to discovering whether any such wheat exists, over 70 varieties are being tested this season in Pembrokeshire and Cardiganshire. In the meantime attention should be concentrated on the Barberry. It should be rooted up, not merely cut down, wherever it occurs. Such a large number of bushes occur in the area that a determined and concentrated effort is needed. Every bush destroyed means a handicap on the spread of the fungus, and by energetic attack there is no reason why the fungus should not be eradicated, and as a result greatly increased wheat crops be secured.

* It should be noted that the Barberry which takes the Black Rust is the common or European Barberry, *Berberis vulgaris*. So far as is known, *B. Darwinii*, *B. stenophylla* and many other garden species do not become rusted.

THE NATION'S FRUIT AND VEGETABLES:

PROBLEMS OF PRESERVATION.

S. L. BENSUSAN.

IN the old days, when every country town or village was by way of being a self-supporting unit, when rail transport was scarcely known and the still room was yet an adjunct of every well-kept country house, it seems likely that there was little or no waste of fruit, flowers, or vegetables. The amount of produce that was likely to be consumed was well known, and at the same time there was a spirit of healthy competition among housewives, who regarded their special methods of making preserves, pickles, jellies, perfumes and simple medicaments as the best possible methods, greatly superior to those practised by their neighbours.

What a wonderful array of home-made produce the old-time country house could command! From a diary more than a century old, the writer has taken the following list of dainties made in a country house that stood some twelve miles from the Bank of England. The house has gone long since; a drapery store has usurped its place, lines of slate roofed villas stand on what were once secluded gardens, and electric trams rumble along where an orchard supplied most of the raw material for still room and kitchen. But the diary with its discoloured pages and rather angular, faded writing, still remains to tell the story of the Chatelaine's work and the results. Here are the good things mentioned in the diary as being made in the years when Mr. Pitt gave instructions that the map of Europe should be rolled up as it would not be wanted for many a day to come:—

Mallow Pâtés.	Cowslip Wine.	Crab-apple Jelly.
Elder Wine.	Dandelion Wine.	Barberry Jelly.
Elder Jelly.	Gooseberry Wine.	Quince Jelly.
Elder Flower Water.	Wild Cherry Liqueur.	Cranberry Jelly.
Lavender Water.	Black Currant Gin	Bullace Jelly.
Gilly Flower Water.	Sloe Gin.	Blackberry Jelly.
Parsnip Wine.	Sloe Tea.	Conserve of Wild Strawberry.
Rhubarb Wine.	Marigold Tea.	
Wild Rose Wine.	Apple Bread.	Damson Cheese.

With the growth of transport and the development of small towns into big ones, with the coming of the factory and the compulsion it exercised upon the lives of men and women, the small markets ceased to be small, and home-made produce fell from its high estate. The era of mass production had opened. Transport developed by road and rail, growing in utterly haphazard fashion

that took no note of anything beyond the requirements of the day and the convenience of the middleman.

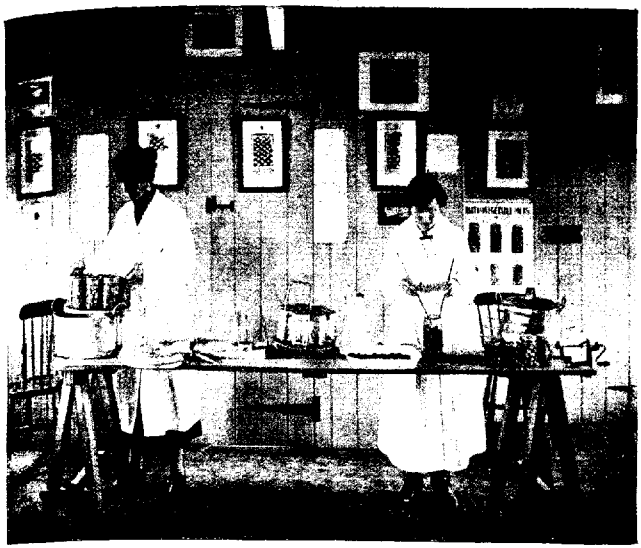
There are two very definite results of this condition. In the first place, the grower is at the mercy of the market; in the second place, the urban consumer seldom or never obtains any advantage from Nature's bounty. If there be a shortage, he pays because things are scarce; if there be a very plentiful supply, he pays because there is no proper machinery to regulate market movements and no effective transport to take perishable goods quickly and cheaply to parts where they are required. The Astor Commission on investigating the conditions of our milk supply discovered that the average daily consumption per head in this country is under a quarter of a pint, and that there are whole districts in manufacturing centres where the milkman is almost unseen if not unknown. In like fashion there is no doubt but that a Commission on the distribution of fruit and vegetables would be able to show that while the consumption of fresh produce is limited to certain classes of the population, there are thousands of men, women and children who never obtain the really fresh supplies that are so important a factor in building up and maintaining health and strength. It is possible, round great urban markets, to see wagon loads of good food being taken to the destructor; it is possible in rural areas to see fields of cabbages and other vegetables being ploughed in for lack of a market. Pigs may be watched eating their fill on the floor of many an orchard, while the housewife whose purse is slender may be compelled to deprive her family of both vegetables and fruit or to purchase them in the smallest quantities at a high price.

This condition of things is, of course, due in the first instance to faulty organisation of markets, and perhaps in part to the greed of those who dominate them; but over and above this cause of trouble we have the national ignorance of the methods of home preservation. The Californian farmer who was asked what he did with his peaches said "We eat what we can, and we can what we can't," and we see the result of this method in the countless tins of fruit that reach our shores year by year. We see, too, the dried vegetables and the bottled vegetables, the crystallised fruits, the sauces, essences, pickles and the rest that are made in countries no more productive than our own, and are sent thousands of miles to pay a profit to the producer, the many intermediaries, the wholesaler and the retailer. This condition has obtained for many years, and it needed the great awakening of a world-war to establish a state of mind in which

people at home would realise that the utilisation of home-grown products is worth a very considerable national effort. By making this country able to turn its own to the best advantage, we place ourselves beyond the need of depending upon foreign supplies.

In 1914 the then Board of Agriculture appointed a special Committee, one of whose objects was to carry out experiments on a factory scale in order to improve the methods of preserving and drying fruits and vegetables. This object was sacrificed to some extent by giving over the factories at Dunnington and Broom in Warwickshire to increasing the food supply for the fighting forces by the manufacture of dried vegetables and jam. Since the close of the War the experimental nature of the work has received more attention, and the existence of many problems has been recognised. For example, shortage of sugar led to careful inquiry into the conditions under which the housewife makes jams, and it was found that she was using far more sugar than is required and producing far less jam than is needed. It was discovered, too, that certain classes of fruit and vegetables lend themselves much more readily to treatment than others, and that to obtain the best results a period of patient research was called for. The laboratory and the trained chemist must be available all the time, and fortunately there is at Long Ashton, near Bristol, a Government Research Station, directed by Professor Barker, that is at work on many of the problems which have assumed an almost national importance. With this Institution the Experimental Station at Campden is particularly concerned.

The Development Commission, to which this country is indebted for so much invaluable work, considered, when the War was over, the position of the establishments concerned with the preparation of fruit and vegetables for the Army, and came to the conclusion that, while some should be closed, the station at Campden in Gloucestershire might well be maintained and developed in order to demonstrate to traders, small holders and housewives the most economic methods of preserving vegetables and fruit, and to show all concerned how a surplus of any kind can be most usefully handled. In these days of great trading combines it is possible for a group of merchants to establish a laboratory and to employ skilled chemists, but it is, of course, unreasonable to expect that they will communicate the results of their work to the small man who desires to set up in business and is a potential rival. They are likely too to be more concerned with science as applied to commerce than with science as



Bottling Plums at Campden.

Students engaged in Canning Operations, Campden.

applied to production under the most hygienic conditions. The Government, without desiring to interfere in any way with the welfare of great firms and combines, does not wish to see the small man eliminated.

It has been the settled policy of the Ministry of Agriculture for some time past to develop horticulture in all its branches, and it may be taken to be a part of this policy that has brought the Experimental Station at Campden in Gloucestershire into being. In general terms the object of the station is to disseminate information that will prevent waste, enable surplus to be wisely used, and reduce the burden of expensive imports. The methods adopted are to train the trainer in the first instance, that is to say, to take people nominated by County Education Authorities, Agricultural Colleges and other educational institutions, and teach them how to teach. Then the small co-operative societies and even the householders can take their turn and obtain their training, while the man or woman who desires to set up in business on a small scale—a business which as it cultivates and handles the fresh fruits of the earth must be deemed to be extremely attractive—will find that the greater part of the problems that beset an endeavour on its way to success have been solved, and that the rest are in process of solution.

The range of teaching embraces at present canning and bottling, pulping, jam-making on practical and economical lines, the drying of vegetables, the making of pickles, preserves and liqueurs and the crystallising of fruits. One cannot help hoping that this programme will be extended in the future to cover the more attractive recipes of the old still room, that it will teach the possibilities of the herb garden, that it will give us the cordials of the old-time housewife, pleasant drinks like mead and morat, English wines and the best of the stock-in-trade of the herbalist: all those things, and indeed more than those things, referred to on the opening of this article. These developments find no place on the present programme of the Institution at Campden, but it may be hoped that they will arrive in time.

The Institution is at present in its infancy. Its singularly unattractive building is most happily set in a valley surrounded by orchards and has a railway station for neighbour. At the time of writing, the county bricklayers having decided to strike, building operations have been suspended, but the "Home Kitchen" Classes are being held, and only the Commercial Classes are postponed by the strike, possibly until the spring of next year. Canning, bottling, pulping and the rest are care-

fully taught, but always to limited numbers so that individual attention may be given, and the recommendation that follows a successful examination at Campden is being accepted already by institutions that are looking for skilled workers.

It must be remembered that the work when started in 1914 was on a very modest scale, that it was developed at first as a war-time undertaking, and that it is now in a state of transition from activities that had in them a definite commercial side, to work that is following scientific and educational lines as originally intended. At the same time the Campden Experimental Station is in the proud and rare position of being able to claim that it has carried on work in the public interest at no cost to the ratepayers. The profits on vegetable drying, jam-making, pulping and the rest in the factories at Broom and Dunnington have enabled £9,000 of the original grant to be repaid, and at this present moment the remaining assets exceed the balance of all liabilities by some thousands of pounds—a result that in the very nature of things must be unexpected when a Government undertakes emergency work in war-time and proceeds to develop an industry for national ends and without any care for commercial issues. It seems likely that Campden will continue to pay its way. The very clear system of accounts in vogue at Campden—a system that has won praise from gentlemen whose normal function is criticism—is a testimony to effective business management.

Students coming to Campden have accommodation found for them, arrangements having been made with various people in the neighbourhood to give board and lodging at, approximately, two guineas a week, and it may be that in the course of time, if the work develops, Campden will approach the status of an Agricultural College and that its recommendations will have even greater value than they possess to-day. Down to the present the only public attention that has been drawn to the work being done at Campden has been a circular letter from the Ministry of Agriculture to Local Authorities, and as a result of this, between the beginning of June and end of July 40 students took a fortnight's course. It is now found necessary to establish a waiting list in order that there may be no overcrowding.

We have at Campden the beginnings of a great and significant experiment, one that may recover many half-forgotten secrets of the countryside, and may teach those who produce fruit and vegetables on the most modest scale some of the recipes that were known of old time only to the fortunate few.

THE HARVESTING OF MANGOLDS.

WILFRED S. MANSFIELD AND ARTHUR AMOS, M.A.,
School of Agriculture, Cambridge.

IN consequence of several complaints that reached the Cambridge School of Agriculture during January as to the poor keeping qualities displayed by some crops of mangolds that season, an inquiry was made in the Eastern Counties with the object of ascertaining the cause of the trouble. A total of 70 replies was received, which showed the following results:—

Variety.	Total No. of Returns.	Keeping Well.	Keeping Badly.	Keeping Indifferently.
Yellow Globes ...	44	30	11	3
Intermediate ...	10	7	1	2
Tankard	12	12	—	—
Long Red	4	4	—	—
Total	70	53	12	5

The season was an exceptional one, dry weather at sowing being followed by a dry autumn, with sharp frosts occurring unusually early, long before the bulk of the crop had been harvested. In spite, however, of the early frost no connection could be shown to exist between the crops which failed to keep and the frosting, except in the one case of the Red Intermediate mangold. The cause of failure in the remaining 11 cases, which were reported as keeping badly, was not so apparent, but it was found that the following points were common to each case:—

1. Harvesting began early—in the second and third weeks of October.
2. The land was dry and hard at the time of lifting.
3. The roots were carried free from any adhering dirt.
4. The mangolds were all of the Globe type.

Other factors which were examined included differences of soil, care in handling the roots, and manuring, but the returns showed that decay of the roots was independent of any of them. It may, therefore, reasonably be assumed that the decay of the mangolds was connected with the four above enumerated points which were common to all the failures.

On the Plant Breeding Farm at Cambridge, where similar Globe mangolds were pulled, topped and lumped early in October, the mangolds were intentionally left in the lumps protected with leaves, until rain had fallen and the roots had a chance to absorb water. These mangolds would thus have escaped the bruising of loading and unloading until they had had longer to mature and absorb water, and it was found that they kept well.

It was not possible to examine in detail all the cases of failure

reported, but on the University Farm, Cambridge, where one of the failures occurred, careful observations were made. It was noticed that decay always started either from the tip of the mangold, where the tap-root had been broken off or damaged in the process of pulling, or from various spots on the sides of the root which had been bruised, although every precaution had been taken to prevent damage in carting. In no case was decay observed at the crown of the root.

In no case, in which Globe mangolds kept well, did lifting commence before the last week in October, by far the greater part of the work being done during November, and in some cases as late as December. In two cases, however, Tankards, which were lifted in the third week of October, are recorded to have kept perfectly, and in one of these cases the Tankards were grown and harvested under identical conditions with the Globes which rotted.

The conclusions to be drawn from the facts recorded are:—

(i.) Globe mangolds, and especially the free-growing watery varieties, are less likely to keep well than the closer-textured Tankards and Long Reds, which contain a higher percentage of dry matter in the root.

(ii.) The primary cause of decay was early lifting and carting, when the ground and the mangolds were abnormally dry; the leaves were apparently ripe, but this was probably misleading and occasioned by the droughty weather.

(iii.) In one case Globe mangolds were lifted early, but not carted until wet weather set in. These kept well. It would seem, therefore, that under dry harvesting conditions, mangolds may be pulled and lumped, provided that they are not carted until wetter conditions prevail.

Among the replies received many sound precautions in the harvesting and clamping of mangolds were emphasised, of which the following may be mentioned:—

1. Mangolds should not be lifted until ripe.
2. Unless the roots are fully mature, they should be left a few days in lumps in the fields before carting and covered with their own leaves.
3. Care should be taken not to injure the skin of the roots, either with the knife in topping, or in carting. Forks should not be used in loading.
4. If exposed to frost in the field, ample time should be allowed for the frost to escape and for the mangolds to recover before they are touched.
5. The clamp should be covered with dry, clean straw, if possible; frost penetrates wet grass brushings much more easily.
6. Covering with earth should not take place until active heating has stopped.
7. Ventilation should always be provided at the top of the heap.

HAND LOOM WEAVING.

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IN this and many other countries Home Industries Associations have often rendered important service. Individuals or communities, usually urged by some energetic and sympathetic personality, have developed an interest in one or other of the many forms of activity grouped under the term "home arts and industries." In some countries, as, for example, Canada, conditions have favoured the maintenance of such industries; but in England, of the many communal and individualistic industries started, very few have persisted. The question naturally arises, therefore, whether there is a place for home industries in England or whether the conditions are such that no industries of this type, even if started on a reasonably sound basis, can be expected to survive.

Until the industrial era of the Nineteenth Century the industry of hand loom weaving was almost solely of the home industry type, and it is possibly worth considering whether it can be re-established on successful lines. This will of course depend largely on whether hand-weaving can be made interesting, useful, and financially profitable.

There is no doubt that hand loom weaving in the home may be made an attractive pastime and within certain limits also a profitable occupation. With one or two possible exceptions, no serious attempt has yet been made to promote the study of the fundamentals of weaving, the knowledge of which would result in growing interest and steady application on the part of the workers. Should a thoroughly efficient business-like association ever be developed it is quite possible that eventually an art of hand loom weaving, approaching in interest that of tapestry weaving, might result.

An efficient loom, as well as an intelligent grasp of weaving mechanisms, cloth structure and colour is essential. Given the right type of loom, and knowledge on the part of the worker also, useful work can be performed. With a machine of useful width and construction and a supply of materials suited for weaving nicely coloured, sound structures, every normal well-trained weaver should be able to produce fabrics of excellent wearing quality and bearing some marks of the personality of

the producer, and yet quite equal to anything produced by the power loom.

Whether hand loom weaving can be made profitable must depend on two considerations, the direct and the indirect aspects of the industry. Directly, it is very questionable whether hand loom weaving will pay except in the manufacture of extreme fancies in either colour or figure. A plain industry, however, which is not directly a paying concern, may ultimately lead on to the real art-industry, and so may be well worth initiating. Thus under right conditions of equipment, control and sympathetic stimulation, even a plain industry, designed for the production of very simple fabrics, might almost be made to pay directly, and when indirect benefits were taken into account might very probably be developed on permanently successful lines.

Emphasis, however, should be laid upon the selling factor. In the case of such an industry as hand loom weaving some centres might be situated in proximity to pleasure or health resorts where there would probably be no difficulty in disposing of the surplus goods produced, but in organising hand loom weaving on a large scale it would be necessary to start selling agencies in suitable centres,* or else place the products of the industry in the hands of a really capable merchanting firm. If lasting success is to be achieved one if not both of these methods must be adopted. Considerable quantities of cloth might be disposed of among the surrounding village communities, and in some cases the industry would manufacture wool for the local farmers, but the produce of an efficiently organised industry would be sufficiently great to necessitate a larger outlook from the selling point of view.

Thus in facing the problem of making such an industry as hand loom weaving a real attraction in rural life, the factors of interest, of usefulness and of economic value should each be given due consideration. If the participants could form an association showing zeal and enterprise, remarkable results might be obtained. A Home Industries Association might also rear flocks of sheep producing wool specially suited to the requirements of the home industries. It might establish a woodwork factory of its own for the production of its spinning wheels, jennies, and hand-looms; start its own central wool carding plant, thus favouring the development of wheel or jenny spinning

* This has already been done in the case of the Canadian Home Industries Association.

in many communities; and also instal in the most suitable and central position its own "dyeing and finishing" plant.

For the successful commencement and maintenance of a scheme such as is outlined above, each worker should be made to feel that he or she is a factor in an interesting and growing industry.

The following requirements are essential in hand loom weaving:—

1. The possession of a really efficient hand loom. A loom well suited for the purpose has already been designed in the University of Leeds, and patterns would be at the disposal of a Home Industries Association.

2. The provision of yarns suitable in quality, thickness and colour. Temporary arrangements for securing this have already been made by the University of Leeds, which might also render valuable aid to associations to make permanent provision.

3. The assistance of intelligent organisers is very necessary. Even more skilful organisation is required for hand loom weaving than for power industries.

The "finishing" operations might well be arranged temporarily in conjunction with the Leeds University, or permanently with certain recognised dyers and finishers.

The necessity for the satisfactory disposal of the goods has already been referred to. The organisers of the several weaving centres should be kept informed as to which goods obtain a ready sale, so that such goods may be produced.

In conclusion, the writer would urge that unless such an organised scheme as that outlined is taken in hand, the question of hand loom weaving in rural districts is not likely to succeed. Even the smallest scheme would necessitate considerable capital expenditure, but the provision of the requisite capital might be made the test for sincerity and earnestness of purpose. It appears to the writer that the scheme would need to be stimulated by generous grants in the first place, but that the Association should ultimately be entirely in the hands of the workers. Some such scheme as that evolved for the Scientific Research Associations might well be adopted. The stimulus such a scheme might be to the worker can well be imagined. To control his own activities, to feel himself part of a growing, prosperous organisation, and to revel in "Threads of Thought and Colours of Fancy"—what possibilities there may still be of a happy, contented life in Rural England!

GROWING LATE FLOWERING RED CLOVER OR SINGLE CUT COW-GRASS FOR SEED.

LATE Flowering Red Clover or Single Cut Cow-grass is a valuable plant for inclusion in leys, especially in those remaining down for two years or more. This clover is a more bulky plant than Broad Red Clover, but it flowers and matures later, does not produce so much aftermath, and yields only one substantial crop in a season. However, it " holds " on the ground longer than other varieties; it often yields well in a second year's hay crop, and frequently contributes appreciably to the herbage in the third year. 1½ lb. per acre should be included in the seeding of a two year ley and up to 4 lb. per acre in leys of from three to six years.*

Late Flowering Red Clover, although susceptible to clover sickness (whether caused by eelworm or stem rot) is more resistant than Broad Red Clover. In spite of these advantages the former is very sparingly used compared with the latter, and it is very desirable that its use should be extended. At the present time, a considerable quantity of the clover used in England is imported, and as, for long duration leys, it is important to use seed harvested in England, there is in this country a good opening for the growth of increased supplies. This end might be partly achieved if growers would substitute Single Cut Cow-grass for Broad Red Clover in every second or every third rotation; this is in itself a desirable procedure on account of the heavy annual loss through clover sickness in the clover growing areas—particularly East Anglia.

Growing for Seed.—Single Cut Cow-grass is principally produced in Essex, Suffolk, and to a less degree in the other Eastern Counties, and in Hampshire, Gloucestershire, Berkshire and Wiltshire.

Cultivation and Manuring.—The cultivation does not differ from that ordinarily adopted for the cereal nurse crops. A dressing of phosphatic manure should be given to the nurse crop, *e.g.*, 5 cwt. of basic slag in autumn or 5 cwt. of superphosphate in spring, per acre.

Seed and Sowing.—The only universally reliable character by which to distinguish Late Flowering Red Clover from ordinary Red Clover is the time of flowering. Locally grown seed should be sown, because the character of the crop can be

* At Cockle Park on soil very subject to clover sickness 5 lb. is included in a mixture for a one year ley.

definitely ascertained, while the buyer is exposed to risk (owing to confusion of names) if he buys seed elsewhere.

The seed should be drilled into the cereal crop at the usual time in spring at the rate of 8 lb. per acre. It should be rolled in, and if the soil is dry at the time of sowing heavy rolling is advisable.

Subsequent Treatment.—After the harvest of the cereal nurse crop the clover should be rolled. The crop is not usually fed the same autumn, though calves are sometimes put on in Hampshire and sheep in the Isle of Wight (where growth is stronger). The clover may be slagged or dunged in winter, but usually is not directly manured. If it is intended to take seed it is not advisable to graze or mow for hay in the early part of the season. As a rule only one seed crop is taken from a ley. If cut for hay the first year a seed crop may come the second season.

Harvesting.—The crop is usually harvested in August or September, but it can stand later than Broad Red Clover, and may even be carried up to November, under exceptionally favourable weather conditions.

Readiness for harvest is indicated by the depth of brown colour of the field as a whole, and ripeness of seed is usually judged by picking heads and rubbing them out in the hand. The crop is cut with an ordinary mower, or with a side delivery reaper which leaves rows of little heaps instead of swathes; the self-binder has been successfully used.

It usually lies for about two days in good weather, and is then turned with the fork, the heads being kept up as much as possible. No wind rows are made—the small pikes are pitched direct. Stacks are made rectangular, rather long and narrow to prevent heating. If the crop is well dried, chimneys are not necessary.

Threshing.—Usually, threshing takes place the following spring; growers recommend that stacks of Late Flowering Red be left for threshing till after the other clovers have been dealt with. The operation is carried out with a " combined " threshing machine.

Crop.—The average crop is about 260 lb. per acre. A maximum of three times this yield may be obtained under specially favourable circumstances.

Disposal of Straw.—If fodder is scarce the stalks may be used as chaff in a mixed food for cattle, but this cannot be regarded as a high-class fodder. In other cases the stalks are used as litter.

DOMESTIC FRUIT BOTTLING WITH OR WITHOUT SUGAR.

FRUIT which is left exposed to the air will go bad. It may be preserved almost indefinitely if it is properly bottled. The reason why perishable fruits go bad so quickly is that under ordinary conditions the germs of decay present on their surfaces begin to grow, increase in numbers, and set up decomposition in the fruit. These germs may be already present on the fruit when it is put into the bottle, or, unless the bottle containing the preserved fruit is made air-tight, small quantities of air passing into the bottle may carry them in with it. In order to preserve fruit it is necessary: (1) to destroy or stop the growth of any germs already on the fruit, and (2) to seal the jar containing the fruit so that further organisms in the air are prevented from reaching it.

These objects are carried out by placing the fruit to be preserved in a suitable jar and then raising the temperature sufficiently to destroy or render inactive any germs present on the fruit. This having been done the jar is sealed so as to prevent germs from entering from the outside. The method of destroying the organisms or rendering them inactive is termed pasteurisation, and usually consists in heating the fruit in water or in syrup, though the fruit may also be heated whilst in a dry state, boiling water or syrup being poured over it afterwards to prevent it from drying during storage.

Bottling is the most economical method of fruit preservation at the present time when sugar is dear, because:—

(*a.*) The use of sugar is not essential.

(*b.*) The process is simple and inexpensive.

(*c.*) Fruit can be preserved whole for tarts or stewing or in pulp for jam-making at a later period.

In view of the world shortage of sugar, the bottling of whole fruit cannot be too strongly recommended, because of all methods of preservation, this requires the least amount of sweetening to render the fruit sufficiently palatable for table use.

Method with Special Bottles or Jars.—Apparatus required:—

(*a.*) *Bottles.*—Screw top or clip top glass jars are usually obtainable from any ironmonger. The cheapest type of jar has a tin lid, but this is not so good as the others mentioned. Screw top jars are the best,

though those supplied with a metal spring are quite satisfactory. Before use, the bottles—particularly new ones—should always be tested for flaws as the seating for the rubber bands is apt to be imperfect; sometimes a small ridge is left at this point in the making, and must be removed with a file in order that the cap will fit quite evenly with no sign of rocking.

(*b.*) *Steriliser.*—When small quantities of fruit are to be bottled, a large saucepan, boiling pan, fish kettle, or similar vessel for heating water will suffice, provided it is deep enough. For fairly large quantities, a pan holding one or two dozen bottles is necessary. A sterilising outfit (several makes of which are on the market) may be usefully employed.

In using any ordinary pan as a steriliser it is essential that a false bottom be fitted, as the bottles must not touch the bottom of the steriliser or boiling pan. A wire frame or strips of wood nailed together trellis fashion will answer the purpose.

(*c.*) *Thermometer.*—For successful work a thermometer is necessary. One of a "floating dairy" type which registers not less than 212°F. is very convenient, or the rather heavier stem variety answers quite well. A rubber washer will hold it in position.

Note:—It is essential that great care be exercised in the choice and renewal of rubber rings, as faulty ones are often the cause of failure. When rings are kept from one year to another they are apt to "perish." Unperished rings, when stretched, will return to their original size, and when pinched, will not crease. It is cheaper to cast a doubtful ring than lose a jar of fruit.

Selecting and Preparing the Fruit.—Slightly under-ripe fruit gives the best results in bottling. If all the fruit is not of this class, the ripe and unripe fruit should be separated and treated independently. Grade carefully so that each bottle contains even sized specimens. Wash well in cold water, with the exception of fruit like raspberries and loganberries; these would lose flavour if so treated. Preparation before bottling varies somewhat according to the fruit, *e.g.*, gooseberries should be topped and tailed; currants lightly shredded from their stalks; rhubarb skinned and cut into pieces of a uniform size; cherries must be

stalked, and, if possible, stoned; the hulls should be removed from raspberries; large juicy plums may be cut in half before being placed in the bottle; peaches and nectarines should be skinned, stoned and halved; apples and pears must be peeled and "quartered." A silver or plated knife only should be used for preparing fruit.

Pasteurising.—Pack as tightly as possible in the bottles without bruising the fruit. Fill the bottles with cold water to overflowing. Place on the rubber ring, cap, and screw band or clip; screw up and then release slightly to allow air to escape during pasteurisation. Clips or springs allow the air to escape automatically. Place the bottles in the pan in which they are to be pasteurised, the cold water in the pan being within an inch of the tops of the bottles. Different fruits require different treatments, but for most fruits the following method will be found satisfactory:—

(*a.*) *With Thermometer.*—Bring to the required heat slowly at the rate of approximately 2°F. per minute. A temperature of 155° to 180° is necessary. (*See* time-table at page 570.)

(*b.*) *Without Thermometer.*—Bring the water very slowly to simmering, or until the hand cannot be held on the pan lid. When this point is reached, lift up a bottle for examination. If the fruit is still firm in the bottle put it back in the pan, but so soon as it begins to move about when the bottle is twisted, it is ready to come out.

Should the water in the pan become too low through boiling, more should be added, but it must be of the same temperature as that in the pan.

When ready, the bottles should be removed, the covers at once securely fastened down, and the bottles allowed to cool slowly. Hot bottles must not be placed on anything cold, or they may crack. When quite cold, remove the screw or clip and test the seal by lifting the bottle by the cover. This test is possible if the bottle and fittings are perfect. If the lid lifts off the fitting is imperfect. Find the fault and remedy it, then re-pasteurise.

"Dry" Method of Bottling.—This method, which is more particularly suited for plums and gooseberries, is very simple and gives results somewhat superior as regards flavour to those obtained by the foregoing methods.

Pack the fruit tightly in the bottles and place in a slow oven until the fruit shrinks slightly; it is then ready to come out. Have boiling water ready, remove one bottle, fill up with the boiling water and fasten securely before taking another bottle from the oven. See that the lids and fittings are warm before being placed on the bottles. This method may be adopted with special bottles, or with ordinary bottles or jars sealed as described below.

Bottling in Ordinary Bottles and Jars.—Glass jars with a special device for sealing are to be preferred, and their use is strongly recommended, but if they cannot be obtained ordinary wide-necked bottles or jars may be used and sealed by one or other of the methods described below. The necks of the bottles should not be larger than is necessary for the insertion of the fruit, and should be so formed that air can be absolutely excluded by sealing. The chief difficulty in using ordinary bottles and jars is that of securing a sufficiently germ-proof seal. Several forms can be made to serve, if carefully applied, but it is advisable to examine the bottles in store from time to time in case fermentation or mould-growth occurs in any of them. If this happens, the contents should be consumed without delay, or the affected fruit should be treated again and re-sealed. Ordinary bottles or jars should not be packed so full of fruit as special bottles, on account of the sealing necessary to render them air-tight. Otherwise, pasteurisation should follow the lines of bottling in special bottles.

Methods of Sealing.—The old method of tying a piece of bladder over the mouth of the bottle is fairly satisfactory. Bullock bladders, obtainable from a butcher, should be washed and soaked in warm water to soften them before use. They should be tied on with string, having been cut previously into pieces of such size as will leave a fair-sized margin below the string after tying. Better results are obtained by purchasing parchment paper jam covers for pasting or gumming on, provided that the bottles are afterwards kept in a cool, dry place. Corks may be used instead of bladders, scalding them well first and then, after insertion, sealing the tops with sealing or bottle-wax. Mutton fat is sometimes used. It is poured on the surface of the water in the bottle so as to form, when cool, a solid block of fat in the mouth of the bottle.

Other methods are :—

(a.) Two layers of parchment paper, pasted or gummed

separately one over the other, placed over the bottle and tied with fine string.

(*b.*) Three or four layers of writing or ordinary paper, pasted, gummed, or starched separately, one over the other, and then tied tightly with fine string.

(*c.*) Three or four layers of tissue paper dipped in milk and placed separately over the mouth and tied tightly with fine string.

(*d.*) Calico, linen or cloth, cut to size, with paper rounds to lie exactly on the top of the bottle. Melt together 1 lb. of resin, 2 oz. of beeswax, and 2 oz. of tallow, and paint the cut pieces of material. This sets in a few minutes, and a large number may be made at one time. To use, place the piece of paper on the bottle, lay the prepared seal over it and tie round.

The Use of Syrup.—The use of syrup is not essential, pure water being equally suitable and rather more transparent. Moreover, a thin syrup affects the natural flavour of the fruit without making it sufficiently sweet to render further sweetening unnecessary. Should sugar be desired, a syrup may be made by adding ½ lb. to 1½ lb. of sugar to one quart of water, and boiling until the sugar is dissolved. If syrup is used for "dry" bottling, it may be added to the fruit when boiling in lieu of boiling water. If used for the other methods of bottling, it should be poured on the fruit before pasteurisation, in place of water.

The Use of Saccharine.—The use of saccharine as a sweetening agent for bottled fruits is not recommended, but may be used, preferably when such contents are opened for table use. It is of the utmost importance that the solution made by dissolving

TIME TABLE.

FRUIT.	METHOD.	TEMPERATURES.	TIMES.
All soft and stone fruits.	Starting with cold water inside and out.	155° Fahrenheit	1½ hours, rising to 140° in first hour, and to 155° in next half hour. Maintain at 155° for 10 to 15 minutes for stone fruits, and at 155° for 5 minutes only for soft fruits.
Apples and pears.	As above.	180° Fahrenheit	1½ hours, rising to 150° in first hour, and to 180° in next half-hour. Maintain at 180° for 10 to 15 minutes.
Syruped fruit.	Cold syrup inside.	10° higher than for each above.	1½ hours, as for each above.

saccharine in water should not be brought into contact with metal. For this reason it should be dissolved in a glass or cup and a wooden spoon used for stirring. On no account should it be used when bottles or jars having metal screw top fittings are employed. Saccharine should be added under the same condition as sugar (syrup) when bottling. The density of the solution will depend upon individual taste.

Causes of Failure.

(1.) Over-ripe fruit.

(2.) Imperfect sealing.

(3.) Water too hot causing mushy contents. The temperatures must be strictly observed.

(4.) Cooking too long. The times given must not be exceeded.

Points to Watch.

(1.) Bottles must be scrupulously clean.

(2.) Make sure that the false bottom is in the pan before putting in the bottles, otherwise they will crack. Do not allow the bottles to touch the sides or this also will crack them.

(3.) Bottles should be screwed down tightly one at a time as they are taken out of the pan. Hot bottles must never be handled with a cold or damp cloth as this will crack them.

(This article will also be issued by the Ministry as Leaflet No. 250.)

GOOSEBERRY GROWING.

GOOSEBERRIES are extremely valuable to the market grower both when grown by themselves and as bottom fruit in plantations. Owing to the climate they can be grown to greater perfection in this country than in any other. Of late years extension of their culture has received a set-back from American Gooseberry Mildew, but with the better control of that disease the position is now much improved. The profitable life of well-cared-for bushes may be said to be about 15 years.

Varieties.—In selecting varieties for planting, due regard must be paid to the locality, the particular demand to be met, and to likely facilities for picking. They may be divided into distinct classes:—

(*a*) In certain early districts such as the Cheddar, Exe and Tamar Valleys in the West, and Sandwich in Kent, it has been found most profitable to grow gooseberries for the early green berry trade, and for this purpose Berry's Early and May Duke are the most useful. These are usually marketed in chips or strikes.

(*b*) The heavy cropping varieties such as Whinham's, Berry's Early, Crown Bob, Lancashire Lad, Careless and White Lion, may be picked for sale as green berries, or for jam, or when ripe for dessert. The bushes are usually picked over a number of times. The quantity left to ripen should be governed by the amount of other fruit likely to be on the market, and facilities as to picking. They are marketed in half sieves. If sold for jam the bushes are cleared before or at latest when the berries begin to change colour, and the fruit is sent in half-sieves or in bags.

(*c*) Certain districts find it most profitable to specialise in high quality dessert fruit. For this purpose Careless is grown in Wisbech; Cousin's Seedling in East Kent, especially around Sandwich, and now, to some extent, in Wisbech; White Lion in Middlesex; and Early Sulphur in Middlesex and the Sandwich district in Kent. In addition there are the varieties

such as Gunner, Leader, Leveller, &c., which receive very special culture to produce the finest dessert fruit in the East Grinstead and Worthing districts in Sussex. In marketing these the 4 lb. chip is generally used, but Early Sulphurs from Kent are often sent in Peach Boxes holding 10 lb., while Leveller is carefully graded and the first grade packed in shallow boxes.

Propagation.—This is effected by means of either layers or cuttings, the latter being the better method and more commonly used.

Layering consists in bending down strong healthy shoots and covering with earth to a depth of 8 or 9 in., leaving 6 or 8 in. of their tips free. This should be done about the end of June. In autumn these branches should be cut from the bush and lifted and, where a large root system has been formed, it may be divided into two and both the upper and lower portions of the stem used to form young plants. Although the buds on the lower portion will when it is planted out be upside down, this will not materially affect the young shoots, which behave quite normally.

Cuttings may be taken in the autumn from healthy, well developed ripe wood of the same season's growth as soon as growth has ceased and the leaves have fallen. Weak or rank material should be avoided, as it does not produce good stock. The thickest wood only should be used and this should be cut from 8-10 in. long and, if possible, with a heel or small piece of the preceding year's growth, on account of the large number of dormant buds at the base which readily break, whereby roots are rapidly formed. Cuttings should be planted about 6 inches apart in rows 30 inches apart with as little delay as possible, to avoid any drying out. If, however, the ground is not ready, or the weather is unfavourable, the planting should be postponed until early spring, the cuttings in the meantime being carefully bedded in a sheltered position or stored in moist sand or moss in some suitable shed or building. It is most important that the cutting bed be of a light friable well drained soil, somewhat "sharp" and "in good heart," or poor root systems with correspondingly poor growth will be obtained. The usual method of planting is to take out with spade or plough a furrow with one

vertical side 6 inches deep. The cuttings are placed about 6 inches apart against the vertical side, the ends pressed into the solid ground, and the soil returned 2 inches at a time, each layer being carefully trodden. The secret of success is firm planting, and if the cuttings are lifted at all by frost they must be trodden tight again. In the early spring the top few inches of the land should be kept well hoed to prevent the cuttings drying out.

If required for bushes on a "leg" the cuttings should be disbudded except for some 3-4 buds at the apex and those immediately at the base, the production of suckers being thereby prevented. If, however, for bushes on a stool, no disbudding should be done, as the production of suckers is required for replacing old or diseased branches. During the two following seasons the young bushes will require thorough cultivation and spraying, and in the autumn two years after planting should be ready for planting out in their permanent position.

Location—Soil.—In order to minimise the risk of American Gooseberry Mildew it is important to select a well drained unshaded site where there is a free circulation of air, as close humid conditions are very favourable to the development of the disease.

Gooseberries prefer a deep, cool, well drained loam, but will do almost anywhere, except on extreme soils which are hot and dry or cold and wet. On the lighter soils considerable assistance from bulky organic manures is required.

Preparation of Land for Planting.—The land to be planted out permanently should be thoroughly cultivated to a depth of 12 in. or 15 in. by ploughing, sub-soiling and cultivating, or by double digging.

The best crops to take prior to planting are either potatoes or some other root crop, which permit of the land being thoroughly cleaned, cultivated and manured. If, however, the land has not previously been well done it should be given, prior to ploughing, a dressing of 15-20 tons of dung per acre or an equivalent dressing of some other organic nitrogenous manure.

It is extremely important to have the land clear of couch, twitch, &c., before planting, especially if the bushes are to be grown on the "stool" method. If the soil is thought to be in the least degree acid, or has not been limed for a number of years, it should be given a good dressing; the expense will be well repaid.

Planning.—Gooseberries are best set at 6 ft. square either

when grown by themselves or used as bottom fruit in a mixed plantation. They may be set closer in the rows, and for weak or upright growing varieties such as Lancashire Lad 5 ft. square is often sufficient. Sunshine and good air circulation are such an important aid in the control of fungoid pests that it is essential to avoid overcrowding, especially in mixed plantations. Generous spacing also permits of a maximum amount of horse cultivation.

Forms of Bush.—Gooseberries are usually grown either on a 6-8 in. leg or as true bushes on the stool principle. The former has the advantage of enabling the land to be properly cleared of twitch, &c., but should only be employed on rich soils where the branches are not liable to die back.

The latter is more suitable on the lighter lands, where the branches die back, as these can readily be replaced by the strong suckers which the system produces.

Planting.—Gooseberries may be planted in the autumn, winter, or spring, whenever the land is in good friable condition. If cold wet weather commences unusually early the planting is best deferred until the spring, and the young stock should always be carefully heeled in. Before planting, all broken or straggling roots should be trimmed off and the three to four main shoots cut back about two-thirds to an outside terminal bud. Planting is best done with a spade. The roots should be well spread out and the soil put back should be firmly trodden.

If the bushes are to be grown with a "leg" they should be planted at the same depth at which they were growing in the nursery row; but if for the "stool" form of bush, the lowest branch should start just below the surface of the soil to encourage the production of suckers.

Manuring.—Gooseberries must be generously treated in the matter of organic manures if good bushes carrying heavy crops are required. They respond remarkably to good farmyard manure. Good shoddy, fish, meat meal, or crushed hoofs may be used. Basic slag on heavy soils, or bone meal and kainit on light soils may be applied when these dressings are not given.

Unless the land contains a sufficiency of lime it must be kept well supplied with it. One ton per acre of fresh burnt water slaked white lime every two or three years is sufficient. On the stiffer soils an annual dressing of 5 cwt. per acre of ground white lime is suitable, or on the lighter lands two tons of small chalk every two or three years.

For further information as to manuring, *see* Leaflet No. 314; and as to Liming, Leaflet No. 170.

Cultivation.—The land must be kept in good tilth to conserve moisture, especially while the crop is developing, as on the vigour of the bushes the weight of the crop depends to a large extent. Several hand hoeings will be necessary, and the horse hoe or cultivator should be used every fortnight—especially as soon after heavy rain as possible—until the berries are picked. During the latter part of the summer no more cultivation should be given than is necessary to keep down weeds, otherwise late sappy growth may be encouraged.

Pruning.—With Gooseberries, fruit is borne at the bases of short spurs on wood from 1 to 10 years old, but the finest fruit is produced on young vigorous wood of the preceding year's growth. It will therefore be seen that it is essential to practice a system of pruning sufficiently hard to produce plenty of young growth, and, with varieties which do not form natural spurs readily, a system of spur pruning will be required. Unless closely pruned the weak growing varieties would soon lose vigour, but strong growers, such as Whinham's Industry, require more latitude on good soils, and the leaders of these should not be shortened after the first two or three years.

At the end of the first season's growth 5 to 6 of the strongest shoots should be selected to form the foundation of the bush and should be cut back from one-half to two-thirds according to their vigour, the weaker being cut harder than the stronger, and all remaining superfluous material should be cut back to spurs 1 in. long for the production of fruit buds. It should be borne in mind that the position of the terminal bud which is left aids in determining the direction of the following season's growth of the branch.

During the succeeding annual prunings, the chief points to remember are:—

(1) Do not crowd the bush with too many main branches, which should be so spaced as to admit the sun's rays and the hand of the gatherer. Increase the number as the bush increases in diameter, but keep them well spaced, yet at the same time well furnished with laterals and fruit spurs.

(2) Cut back sufficiently hard to keep the bush vigorous, to ensure a supply of young wood and to cause buds

to break and form fruit spurs, instead of remaining dormant and leaving lengths of bare wood. This cutting back must not of course be excessive, or nothing but a forest of sappy growth subject to disease will result. The severity of the pruning should be governed by the condition of the bush and the response made to the method adopted the previous winter.

(3) Never allow any intercrossing of shoots and cut back everything growing inwards and tending to choke up the centre of the bush. Very strong shoots should be cut right out, as spurs from these rarely form fruit buds and merely produce increased wood growth.

(4) Aim at replacing old worn-out wood with healthy young shoots or suckers. If this is done regularly the vigour of the bush is maintained and the length of its profitable life much prolonged.

(5) The weight of fruit, especially in the case of varieties of a spreading habit, frequently tends to cause excessive drooping of the branches, which leaves the centre of the bush unduly open. These and the lower and outside branches should be cut back to an upper bud and new material trained to fill the head.

(6) Varieties differ in habit and strength of growth, and in their readiness to form fruit spurs. As with other fruits, to obtain the best results each variety requires a careful study of its habits and a system of pruning calculated to counteract its weaknesses and beneficially assist its peculiarities.

Fungoid and Insect Pests.—The Gooseberry, in common with other cultivated fruits, is subject to attack by several insect and fungoid pests, the more serious of which are mentioned below.

American Gooseberry Mildew (*Sphærotheca Mors-uvæ*, Berk).—Fortunately this disease can be controlled by the careful tipping and burning in the autumn of all diseased shoots, combined with thorough sprayings with lime sulphur spray as the buds are bursting in the spring, just after the blossoms are set, and in the late summer after the fruit is picked. Certain varieties are damaged by lime sulphur, and half-summer strength should be used on Keepsake (Berry's Early), Lancashire Lad,

Careless, and Crown Bob. Yellow Rough (Golden Drop) cannot safely be sprayed with lime sulphur at all. (*See* Leaflet No. 195.)

Gooseberry Sawfly (*Nematus ribesii*, Curtis).—The larvæ of this sawfly are frequently very troublesome, attacking the leaves and young fruit which are sometimes entirely cleared off. They are, however, easily checked by thorough spraying with arsenate of lead at the rate of 4 lb. to 100 gallons of water. This spray must not be used within six weeks before the fruit is gathered. For other washes *see* Leaflet No. 12.

Aphides.—Various species may—when conditions are favourable—increase to such an extent as to damage the bushes seriously and prejudice the crop. They may be controlled by very early spraying before the curling of the leaves prevents them being wetted. If the leaves have been allowed to become badly curled, the infested tips should be picked off and burnt. (*See also* Leaflets Nos. 68 and 104.)

Red Spider (*Bryobia ribis*).—This is really a mite, scarcely visible to the naked eye, and may prove very troublesome in droughty summers. Its presence is usually first detected by the characteristic yellow and sickly appearance of the leaves. It may be eradicated early by application of oil emulsion, liver of sulphur and various proprietary washes.

List of Standard Commercial Varieties.

VARIETY AND SEASON.	DESCRIPTION.
Careless	Chiefly grown in Wisbech and East Anglia.
Cousen's Seedling ... (*Sandwich Yellow*)	Chiefly grown in Kent and Wisbech.
Crown Bob	Distributed over a large area.
Howard's Lancer ...	Very similar to White Lion.
Keepsake .. ... (*Berry's Early*)	Widely distributed.
Lancashire Lad ...	Widely distributed.
Whinham's Industry	Widely distributed.
White Lion	A Middlesex favourite.

Descriptive List.

VARIETY AND SEASON.	DESCRIPTION.
Crown Bob ... ... Midseason.	For picking green. Large, red, thin skin, hairy. Growth strong and spreading.
Careless ... ... Midseason.	Chiefly grown for jam or picking green. Large, creamy white, smooth skin. Growth rather slender and spreading. Suitable for Wisbech or East Anglian districts.
Cousen's Seedling ... (*Sandwich Yellow*)	Late dessert. Medium size, yellow, hairy. Makes a small pendulous bush. Much grown in Kent, now also Wisbech.
Howard's Lancer ... Midseason.	Dessert or picking green. Very large, greenish white, smooth, carries well. Growth strong and rather spreading.
Keepsake ... ... (*Berry's Early*)	Ripens late, but one of the earliest for picking green. Medium size, green, hairy. Growth pendulous.
Lancashire Lad ... Midseason.	Dessert or picking green. Large, dark red, hairy. An old favourite, but still does well in most localities.
Whinham's Industry Midseason.	For picking green or for jam or cheap dessert trade when colouring. Large, red, hairy. Growth strong and upright. A favourite market sort, as it succeeds on most soils; is a very heavy cropper and the fruit carries well.
White Lion ... ... Very late.	Very late. Useful as dessert or may be picked green. Large, white, slightly hairy. Growth strong and spreading. Extensively grown in Middlesex on the extension system.

(The above article will shortly be issued by the Ministry as Leaflet No. 346.)

FEEDING STUFFS IN SEPTEMBER.

PROFESSOR T. B. WOOD, C.B.E., M.A.
Animal Nutrition Institute, Cambridge University.

ON the whole there has been very little change in prices of feeding stuffs since last month. English oats are slightly dearer, and imported oats distinctly cheaper, palm-kernel cake has risen in price by 5s. per ton, and ground-nut cake fallen by about £1 per ton, and there have been a few other small changes, but nothing to alter the situation.

Name.	Price per Qr. s.	lb.	Price per ton. £ s. d.	Manurial Value per ton. £ s.	Food value per ton. £ s. d.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv. s.	Price per lb. Starch Equiv. d.
Barley, English feeding ..	90/–	400	25 0 0	1 6	23 14 0	71	6.7	1.61
,, Foreign	80/–	400	22 10 0	1 6	21 4 0	71	5.11	1.37
Oats, English	70/–	336	23 10 0	1 9	22 1 0	59.5	7.5	1.80
,, Foreign	57/6	320	20 0 0	1 9	18 11 0	59.5	6.3	1.52
Maize, Argentine	63/–	480	16 2 0	1 5	14 17 0	81	3.8	0.91
Beans, English spring ..	115/–	532	24 4 0	3 1	21 3 0	66	6.5	1.56
,, ,, winter ..	95/–	532	20 0 0	3 1	16 19 0	66	5.1	1.22
,, Chinese	19/–	112	19 0 0	3 1	15 19 0	66	4 10	1.16
Peas, English blue	100/–	504	22 4 0	2 13	19 11 0	69	5.8	1.40
,, ,, dun	97.6	504	21 15 0	2 13	19 2 0	69	5.6	1.36
,, ,, maple	122/6	504	27 5 0	2 13	24 12 0	69	7.2	1.73
,, Japanese	112/6	504	24 17 0	2 13	22 4 0	69	6.5	1.56
Buckwheat	102/–	400	28 10 0	1 10	27 0 0	58	10.3	2.50
Rye, English	91/–	480	21 5 0	1 8	19 17 0	72	5.9	1.42
Millers' offals—Bran			14 10 0	2 10	12 0 0	45	5.4	1.31
,, ,, Coarse middlings			15 10 0	2 10	13 0 0	64	4.0	0.97
Barley meal			26 0 0	1 6	24 14 0	71	7.0	1.71
Maize ,, ...			18 0 0	1 5	16 15 0	81	4.2	1.03
Bean ,, ...			21 0 0	3 1	18 19 0	66	5.8	1.40
Fish ,, ...			25 0 0	7 12	17 8 0	53	6.9	1.66
Cakes—Linseed			21 0 0	3 12	17 8 0	74	4.8	1.15
Soya			19 15 0	5 3	14 12 0	69	4.3	1.04
Cotton-seed			12 10 0	3 5	9 5 0	42	4.1	1.02
,, meal decorticated			20 0 0	5 6	14 14 0	71	4.2	1.05
Coconut .. .			13 10 0	3 0	10 10 0	79	2.8	0.71
Groundnut			14 0 0	3 9	10 11 0	57	3.8	0.95
,, decorticated			17 0 0	5 5	11 15 0	73	3.3	0.84
Palm kernel			11 15 0	2 1	9 14 0	75	2.7	0.69
,, ,, meal ..			12 5 0	2 1	10 4 0	75	2.8	0.72
Brewers' grains, dry			10 10 0	2 7	8 3 0	43	3.4	0.79
,, ,, wet			1 5 0	12	13 0	15	1.0½	0.27
Distillers' ,, dry			11 10 0	2 16	8 14 0	57	3.1	0.75
,, ,, wet			1 7 6	13	14 6	16	1.1	0.29
Malt culms			8 12 6	3 6	5 6 6	43	2.6	0.64

Cereals generally are still relatively dear, costing 3d. or more per lb. of starch equivalent. Exceptions are Argentine maize, coarse middlings and dried grains which provide starch equivalent at about 2d. per lb. Beans and peas are about the same price per lb. of starch equivalent as cereals. Cakes and oil seed meals are considerably cheaper, the cost per lb. of starch equivalent being from 2½d. in linseed cake to less than 1½d. in coconut and palm-kernel cakes.

There is greater choice of feeding stuffs on the market than there was some time ago. English beans and peas, buckwheat and rye are now quoted.

Undecorticated Cotton Cake.—It is satisfactory to notice that the cake likely to be in most immediate demand, namely, undecorticated cotton-seed cake, at £12 10s. per ton, provides starch equivalent at the reasonable price of less than 2½d. per lb. At this price it will probably be widely used for milch cows at grass. It is specially suitable for this purpose as its astringent properties prevent scouring when the grass becomes watery in the early autumn.

Palm-Kernel Meal for Pigs.—Since last month Messrs. Mackenzie and Fleming have issued, under the title of Modern Pig Keeping, a pamphlet which describes the results of many pig-feeding trials carried out at Cambridge between 1917 and the present time. Their trials have demonstrated the suitability of palm-kernel meal for all kinds of pigs when used under proper conditions. For young growing pigs it should be supplemented with dried blood or some similar product, for fattening pigs with maize meal or some other starchy fat-producing food. Copies of the pamphlet can be obtained for the cost of postage from the Secretary, School of Agriculture, Cambridge. Pig keepers will find the use of palm-kernel meal most economical, as it provides starch equivalent at less than 1½d. per lb. as compared with 3d. or more in the case of most cereal meals.

Dried Blood.—Manufacturers of feeding stuffs appear to be turning their attention to the preparation of suitable samples of dried blood. Foods of this kind, which are prepared from animal products, require great care in their manufacture. If prepared from the blood or offals of diseased animals they are liable to transmit disease. If not properly dried they will not keep. When prepared with proper care, it seems likely that they may be very useful additions to cereal or other meals as sources of protein and of accessory food factors or vitamines.

Fish Meal is another feeding stuff of this kind, but its manufacture has now been standardised. Formerly all kinds of fish refuse were dried together and sold as the evil-smelling product known as fish guano. In this form it could only be used for manure. The fish refuse is now carefully selected. Some of it is still used for making fish guano, but the better stuff is steamed, extracted, dried and ground to a meal, which has little smell,

is fairly acceptable to animals, and has a constant composition of about 55 per cent. protein, 4 to 5 per cent. of oil, and not less than 16 per cent. of phosphate of lime. It should not contain more than 12 to 13 per cent. of water and 4 per cent. of salt. Buyers should see that they get a standardised product of about this composition.

Fish meal of this kind was tested on many occasions during the later stages of the War, and found to be suitable for a great variety of purposes. In using it for all purposes certain facts must be borne in mind. In the first place it contains no carbohydrate, and since this is a necessary constituent of the diet of farm animals, fish meal should always be used in conjunction with starchy foods. Secondly, fish meal is so rich in protein and ash constituents that it is not suitable to form more than a small fraction, say, one-eighth to one-twelfth of the whole diet.

With these reservations it may be used successfully for all kinds of stock—cattle, sheep, pigs, and even horses. Special notes on the use of fish meal appeared in this Journal for August, 1919, p. 480, and August, 1920, p. 414.

Note.—In the issue of this Journal for August (page 415) was given a "Standard Analysis of White Fish Meal," to which the Association of Fish Meal, Fish Guano, and Fish Oil Manufacturers—representing nearly all the manufacturers of fish meal in Great Britain—have agreed to conform. An error in printing occurred in this issue, and the analysis is here reproduced in its correct form.

Albuminoids	Not less than 55 per cent.
Phosphate of Lime	„ „ „ 16 „ „
Oil	Not more than 5 „ „
Salt	„ „ „ 4 „ „

INSECT AND FUNGUS PESTS IN SEPTEMBER.

LITTLE can be done during September to prevent damage by the pests which are now apparent, as during this month crops of all descriptions are being harvested. Notes should be taken, however, of the pests which are prevalent and the damage they cause, in order that precautions may be taken in another season to prevent similar damage.

Vegetables.—Among the general pests causing damage at this period may be placed the various *Cut-worms*. These are the caterpillars of certain moths such as the Turnip Moth, the Heart and Dart Moth, the Yellow Under Wing and others. They are also known as *Surface Caterpillars*, as during the day they usually hide in the upper surface of the soil or under shelter such as leaves, grass, or stones, but at night they come out and feed on the leaves or stems of succulent plants, more frequently on the latter. A common form of injury at this season is for the caterpillars to bite through the stems of succulent plants such as cabbages, especially those which have been newly planted out, but these pests also attack such crops as mangolds, turnips and potatoes. Young cabbage plants are rendered useless by these ravages, and the tops fall to the ground. Such damage is often found where ground is not properly cultivated, the presence of weeds having attracted the female moths to lay their eggs in this place. Where only a small number of plants is to be dealt with the simplest method of preventing further damage is to search the surface soil around the base of injured plant and discover the caterpillars. These vary in colour from a reddish brown to grey or grey-green. Further particulars are given in Leaflet No. 33. In both this instance and in other cases of soil pests much good may be done by regular hoeing.

Owing to the wet summer *Botrytis* in onion plants is likely to be prevalent, and every effort should be made to ensure that the plants are well dried off before storing. Thorough drying of root vegetables before storing is a point that should be emphasised, as many of the roots can only spread under damp conditions, while in a year like the present special attention should be paid to the drying off of potatoes as far as possible before they are pitted.

Autumn-sown onions should be examined very closely while in the seedling stage for traces of *Onion Smut*. This is a disease which as yet is uncommon in England, but is making its

appearance in various districts. It is a soil fungus, and attacks plants only when they are very young. The disease can then be detected, as grey streaks on the leaves and bulbs; later it breaks through as a black powder. Where found its presence should be reported at once to the Ministry.

In many cases runner beans or peas curled or having small dark-coloured spots or patches which sink below the general level of the surface. This is a sign of the *Bean Pod Canker*, and infected beans should not be used for seed, as the resulting crop would show the disease at an early stage of growth and be killed before the flowering season is reached. Full particulars of this disease are given in Leaflet No. 185.

Fruit.—At this time of the year fruit growers are often puzzled to account for the various markings upon fruit, more especially on apples, which are frequently spoiled for market purposes. The commonest of these markings, namely, those caused by apple scab, are fairly well known, and may be shown by dark or russety patches, or in extreme cases deep cuts and cracks. Markings that are not so well known are found in certain districts; these are caused by capsid bugs, and the *green apple capsid*, Plesiocoris rugicollis, punctures the leaves and fruit, and also the shoots of the apple. A full account of the insect and the damage it causes are given in Leaflet No. 319. It may here be stated, however, that the attacked apples are usually deformed; the skin shows rough, russety patches with scattered pits and pimples, indicating the position of the original punctures. As in the case of apple scab, really bad specimens are shapeless, and may have cracks extending deeply into the interior. The best way to control this pest is by spraying with nicotine and soft soap before the blossom bursts.

Brown Rot on plums and apples was mentioned in the notes in the July issue of this Journal. Owing to the wet weather the trouble became serious, and it is probable that there will be a large number of apples attacked by this disease. In such cases every effort should be made to remove and burn all diseased fruit, and where possible to cut out the spurs to which the fruit was attached, as such spurs are now known to be infected.

Among the plum trees, *Silver Leaf* should still be looked for, and trees which are showing a silvering of the leaves should be dealt with or marked if it is not possible to do more. Where only a portion of a tree is attacked it is usually sufficient to cut the diseased part away, but care should be taken that the branch is removed sufficiently far back that no mycelium or

spawn of the fungus is left in the tree. This can be detected by the absence of a brown stain in the wood. In any case it is far better to cut the branch back flush with the trunk. Where the trunk is infected it is preferable to remove the whole tree, and growers are reminded that under the Silver Leaf Order all dead wood of plum trees should be cut out and burnt before 1st April of each year. Silver Leaf chiefly attacks Victoria plums, but it also affects other stone fruits and apples, as well as certain shrubs, more especially the Portuguese laurel. Wherever it is found steps should be taken to cut out and burn diseased branches or trees.

It is during September that gooseberry shoots attacked by *American Gooseberry Mildew* are best removed. During the summer the mildew is seen as a white glistening substance on shoots and young leaves. This, however, by September has usually changed to a deep chocolate brown, and the resting spores are developed. During this month the resting spores commence to fall to the ground, and diseased tips should therefore be removed and burnt as soon as possible. By this time the wood is sufficiently ripe, and fresh growth will not take place. If the tipping is done too soon new shoots are formed, and these frequently become attacked with the white stage.

When cutting out the old raspberry canes care should be taken to remove and burn all rubbish, as the *Raspberry Moth* spends the winter in shelter afforded by the old canes, crevices of the supports, and in rubbish (See Leaflet No. 14.) Another raspberry pest which breeds on the old canes is *Hendersonia rubi*. This fungus attacks young canes during the summer, causing red or purplish patches of variable size to appear on the stem. These increase in size, and during the winter change to a dull grey or dingy white colour. When the bark has been killed on such patches the spores of the disease are produced and these infect young canes in the following season. It is necessary, therefore, that all old canes should be burnt, and any young diseased canes cut out and treated similarly.

In some districts *Apple Sucker* gives a great deal of trouble in the spring, the young larvæ getting into the blossom clusters and sucking the nutriment until the blossom appears as though it had been frosted. The adults are in the flying stage in September, and where the apples have been picked before the insects have laid their eggs it is possible to kill a large number of the pests by spraying. As at this date injury to the leaves is not of great importance, any insecticide, such as paraffin or

creosote emulsion, may be used. The presence of this tiny white fly can usually be detected readily by shaking the tree or branch. Further particulars are given in Leaflet No. 16.

Fruit growers should make preparations for grease banding their trees, and obtain the necessary materials. The reason for grease banding trees is that certain moths, chiefly the *Winter Moth*, the *Mottled Umber*, and the *March Moths*, have wingless females which have to climb the various trees before they can lay their eggs. Full particulars of these moths are given in Leaflet No. 4. The moths first appear above the ground about the end of September, and may appear any time during the next few months, according to soil and other conditions. If the grease on the bands is kept sticky the moths are caught and prevented from laying their eggs on the tips of the shoots. Every moth caught would probably lay several hundred eggs, which in due course would hatch out to the familiar green caterpillars which cause so much damage early in the year. Such bands are of no value in checking the *Codlin Moth*, but the hay bands recommended for this in a previous article (July, 1920, p. 378) should now be removed and burnt.

Cereals.—All cereals should be harvested by September, but it may be mentioned here that the *Gout Fly* or the *Ribbon-footed Corn-fly*, as it is also called, caused much damage this season to wheat and barley. The latest brood will lay its eggs on wild grasses, or on young wheat if this is near. In such cases wheat and barley should not be sown close to a previously infected field. The grass on the headlands should be kept down, and if wheat has to be sown near, the operation should be deferred as late as possible, so that the late brood of flies may find no young plants on which to lay their eggs.

General.—It cannot be too strongly urged that the collecting and burning of refuse in gardens and fields is the best possible preventive of further damage by different pests, since a great many of the common pests over-winter in the refuse heap and frequently find their way back on the land when the manure is distributed in the spring.

For the same reason infected food plants should not be given raw to animals, as in many cases the fungus spores pass unchanged through the animals and are replaced often on uninfected land with the dung. Many fields are infected with injurious soil-inhabitating fungi in this way.

Any of the Leaflets mentioned in this article may be obtained gratis and post free on application to the General Secretary, Ministry of Agriculture and Fisheries.

AGRICULTURAL RETURNS, 1920.

The following memorandum on the Agricultural Returns for 1920 was issued by the Ministry on 13th August :—

Crops.

The preliminary tabulation of the Agricultural Returns shows that the total acreage under crops and grass in England and Wales on June 4th last was about 26,520,000 acres, a net decline on last year of 228,000 acres. Arable land accounts for 12,020,000 acres, and permanent grass for 14,500,000 acres. The chief features of the returns are a reduction in the corn area and an increase in the area of clover and rotation grasses and green crops, together with large reductions in the number of cattle and sheep. In the case of pigs, there has been an increase.

The acreage under Wheat, 1,877,000 acres, is 344,000 acres less than in 1919, and only 70,000 acres above that of 1914. Oats are also being grown to a less extent than last year, the decrease being about 300,000 acres; but the total, 2,267,000 acres, is still 340,000 acres greater than in 1914. On the other hand the acreage of Barley has been increased by 127,000 acres to 1,637,000 acres, the highest acreage recorded since 1904. Beans occupy 258,000 acres, or nearly 10 per cent. less than last year, but the area under Peas has been slightly increased. The total area under Cereals and Pulse is 6,450,000 acres, or 540,000 acres less than 1919, but still some 325,000 acres above the average of the ten years 1910–1919.

Potatoes are being grown on a largely increased area, the total, 544,000 acres, being 70,000 acres greater than last year, and apart from 1918 is the largest on record. There is little change in the root crops.

Among other crops the most noticeable changes are the very large increase, 58 per cent., in the area devoted to vetches and tares, and the comparatively smaller but still large increases in the case of cabbage, kohl-rabi, rape, lucerne and mustard. The area of sugar beet, about 3,000 acres, is about eight times as large as last year, whilst flax occupies 22,000 acres, or 4,000 acres more than in 1919. The acreage devoted to hops has risen by about 4,000 acres. The area of bare fallow, though less than last year, is still much above the pre-war average.

Clover and rotation grasses have been increased by 190,000 acres to 2,448,000 acres, of which about two-thirds, or 1,670,000 acres, were reserved for hay, this being an addition of 170,000 acres. The acreage of meadow hay was also increased, and the total area mown for hay this year was 6,080,000 acres as compared with 5,670,000 acres last year.

Live Stock.

Horses used for agricultural purposes were reduced by 25,000, and there was some falling off in the number of foals, which were 7,000 less than in 1919.

A serious decline is shown in the total number of cattle, the figures being only 5,547,000 against 6,194,000 in 1919, a reduction of more than 10 per cent. and the smallest number recorded since 1903. The decline is most pronounced in young cattle under one year old, the reduction in this class being nearly 300,000 or 25 per cent. The number of young cattle was exceptionally high during the War, but the serious reduction which has now taken place makes the number on farms on June 4th less than in any year since 1893, when the numbers of this class were first distinguished. The number of cattle from

one to two years old is also much less than last year, the reduction in this case being 160,000, or nearly 13 per cent. Cattle above two years old are slightly more numerous, while cows and heifers (in milk or in calf), though reduced by about 200,000 to 2,350,000, are 90,000 greater than in 1913, so that there is ample breeding stock from which to replenish the herds of the country.

Sheep have been largely reduced and the total now stands at only 13,380,000, or 1,750,000 less than a year earlier. This is by far the smallest total ever recorded, and is 5,340,000, or 29 per cent., below the average of the 10 years immediately before the War. All classes of sheep shared in the decline, the heaviest relative reduction being in those one year old and above.

Pigs, on the other hand, are being kept in larger numbers than in the last three years, the total, 1,995,000, being the highest since 1916. Sows kept for breeding increased to a relatively greater extent than other pigs, the addition being nearly 40,000, or about 15 per cent., so that the prospects of a further increase in the number of pigs appear to be good.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1920.

PRELIMINARY STATEMENT for 1920, compiled from the Returns collected on the 4th June; and comparison with 1919.

CROPS.

DISTRIBUTION.	1920.	1919.	INCREASE.		DECREASE.	
	Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL ACREAGE under all CROPS and GRASS (*a*)	*26,519,340*	26 747,950	..	..	228,610	0·9
ARABLE LAND	*12,020,110*	12,308,870	..	..	288,760	2·3
PERMANENT GRASS (*a*). For Hay	*4,406,120*	4,170,510	235,610	5·6	..	..
PERMANENT GRASS (*a*). Not for Hay	*10,093,110*	10,268,570	..	..	175,460	1·7
PERMANENT GRASS (*a*). TOTAL	*14,499,230*	14,439,080	60,150	0·4	..	..
Wheat. Autumn Sown	*1,792,350*	2,074,630	..	..	282,280	13·6
Wheat. Spring Sown	*84,650*	146,570	..	..	61,920	42·2
Wheat. TOTAL	*1,877,000*	2,221,200	..	..	344,200	15·5
Barley	*1,636,770*	1,509,720	127,050	8·4	..	..
Oats	*2,267,100*	2,564,330	..	..	297,230	11·6
Mixed Corn	*148,440*	142,660	5,780	4·1	..	..
Rye	*96,470*	106,520	..	..	10,050	9·4
Beans	*257,640*	284,630	..	..	26,990	9·5
Peas	*165,120*	163,480	1,640	1·0	..	..
Buckwheat	*4,810*	6,310	..	..	1,500	23·8
Potatoes	*544,300*	473,380	68,920	14·5	..	..
Turnips and Swedes	*990,820*	983,400	7,420	0·8	..	..
Mangold	*385,780*	396,050	..	..	10,270	2·6
Cabbage, Savoys, and Kale	*62,090*	51,590	10,500	20·4	..	..
Kohl-Rabi	*11,160*	9,630	1,530	15·9	..	..
Rape	*100,440*	93,230	7,210	7·7	..	..
Vetches or Tares	*121,720*	76,960	44,760	58·2	..	..
Lucerne	*44,490*	38,760	5,730	14·8	..	..
Mustard	*71,860*	63,280	8,580	13·6	..	..
Brussels Sprouts	*12,650*	11,920	730	6·1	..	..
Cauliflower or Broccoli	*8,850*	9,450	..	..	600	6·3
Carrots	*9,640*	11,380	..	..	1,740	15·3
Onions	*4,460*	6,860	..	..	2,400	35·0
Celery	*4,300*	4,150	150	3·6	..	..
Rhubarb	*5,550*	6,110	..	..	530	8·7
Sugar Beet	*3,110*	390	2,720	697·4	..	..
Chicory	*340*	270	70	25·9	..	..
Flax for Fibre	*9,740*	18,460	4,010	21·7	..	..
Linseed	*12,730*					
Hops	*20,760*	16,740	4,020	24·0	..	..
Small Fruit	*60,280*	58,700	1,580	2·7	..	..
CLOVER and ROTATION GRASSES. For Hay	*1,674,020*	1,501,250	172,770	11·5	..	..
CLOVER and ROTATION GRASSES. Not for Hay	*774,280*	757,180	17,100	2·3	..	..
CLOVER and ROTATION GRASSES. TOTAL	*2,448,300*	2,258,430	189,870	8·4	..	..
OTHER CROPS	*67,110*	68,450	..	..	1,340	2·0
BARE FALLOW	*566,360*	650,440	..	..	84,180	12·9

LIVE STOCK.

	No.	*No.*	*No.*	*Per Cent.*	*No.*	*Per Cent.*
Horses used for Agricultural purposes (including Mares for Breeding)	*789,060*	814,200	..	..	25,140	*3·1*
Unbroken Horses (including Stallions) One year and above	*235,700*	230,830	4,870	*2·1*	..	..
Unbroken Horses (including Stallions) Under one year ..	*97,340*	104,000	..	..	6,660	*6·4*
Other Horses	*243,840*	237,790	6,050	*2·5*	..	..
TOTAL OF HORSES	*1,365,940*	1,386,820	..	..	20,880	*1·5*
Cows and Heifers in Milk	*1,827,580*	1,943,670	..	..	116,110	*6·0*
Cows in Calf, but not in Milk	*242,890*	292,290	..	..	49,400	*16·9*
Heifers in Calf	*282,400*	317,530	..	..	35,130	*11·1*
Other Cattle:—Two years and above	*1,178,120*	1,167,080	11,080	*0·9*	..	..
" " One year and under two	*1,108,840*	1,271,290	..	..	162,450	*12·8*
" " Under one year	*907,050*	1,202,580	..	..	295,530	*24·6*
TOTAL OF CATTLE	*5,546,900*	6,194,540	..	..	647,640	*10·5*
Ewes kept for Breeding	*5,107,940*	5,764,300	..	..	656,360	*11·4*
Other Sheep:—One year and above ..	*3,009,850*	3,568,040	..	..	558,190	*15·6*
" " Under one year	*5,261,180*	5,791,970	..	..	530,790	*9·2*
TOTAL OF SHEEP	*13,378,970*	15,124,310	..	..	1,745,340	*11·5*
Sows kept for Breeding	*289,500*	250,750	38,750	*15·5*	..	..
Other Pigs	*1,705,240*	1,547,720	157,520	*10·2*	..	..
TOTAL OF PIGS	*1,994,740*	1,798,470	196,270	*10·9*	..	..

(a) Excluding Mountain and Heath Land used for grazing.

ACREAGE OF HOPS.—The following Preliminary Statement compiled from the Returns collected on the 4th June, 1920, showing the ACREAGE under **Hops** in each COUNTY OF ENGLAND in which Hops were grown, with a COMPARATIVE STATEMENT for the Years 1919 and 1918, was issued by the Ministry on 14th August:—

COUNTIES, &c.	1920	1919	1918
	Acres.	*Acres.*	*Acres.*
KENT ... East ...	3,260	2,530	2,370
KENT ... Mid ...	4,520	3,650	3,340
KENT ... Weald ...	5,470	4,380	4,030
KENT ... Total, Kent ...	13,250	10,560	9,740
HANTS	820	760	720
HEREFORD	2,990	2,420	2,330
SURREY	170	180	190
SUSSEX	1,790	1,410	1,310
WORCESTER	1,680	1,370	1,330
OTHER COUNTIES	60	50	50
TOTAL	20,760	16,750	15,670

NOTICES OF BOOKS.

National Council of Social Service—Monthly Bulletin.—(London: P. S. King & Son, Ltd., Orchard House, 2 & 4, Great Smith Street, Westminster, S.W.1, Price 3d.) With the object of being helpful to the ordinary citizen who is giving some form of social service, Number 1 of this series of Monthly Bulletins makes its appearance. It may be hoped that it will achieve its object. In an editorial foreword it is stated that "A wider conception of the State, as an association of citizens united for the common purpose of securing the fullest and freest life for all, has secured general recognition during the War, and has resulted in the acceptance by the Government of wider responsibilities for the care and welfare of the people."

Among the varied contents of the Bulletin's dozen pages is an article on "The Future Provision of Medical Services" which explains the re-organisation scheme outlined in the Interim Report of the Consultative Council on Medical and Allied Services, Ministry of Health. Under the title "Workers in Council" the aims of the National Council, which was formed in March, 1919, are set out. These include a survey of the whole local field of work, the prevention of overlapping and the development of co-operation in aim and effort. "Urban Notes" and "Rural Notes" describe the growth of the movement in their respective districts. The Council has a special Rural Department, of which Sir Henry Rew is Chairman, which comprises representatives of the National Farmers' Union, the Village Clubs' Association, the Women's Institutes and other organisations concerned with rural development. The information under the titles "New Legislation and Administrative Circulars"; "Bills before Parliament"; "Government Reports"; and "Some New Books," cannot fail to be of great interest to social workers. The Bulletin will keep them well abreast of the ever growing movements of progress.

Handbooks of Information on Social Service are also issued by the National Council of Social Service. The first of these, entitled "Public Services," has recently been published for the Council by P. S. King & Son, Ltd., Orchard House, 2 & 4, Great Smith Street, Westminster, S.W.1. Price 2/- net. Originally issued as a pamphlet by the Joint Committee on Social Service in 1917, this Handbook appears to have proved of practical value, 14,000 copies having been issued. Revised and brought up to date with the assistance of the Government Departments concerned, the second edition of the Handbook will be of even greater service. The 96 pages are divided into 8 chapters dealing with Public Health, National Health Insurance, Poor Law, Old Age Pensions, Education, Industry and Employment, Administration of Justice and War Pensions (Allowances and Medical Services). Used in conjunction with the Monthly Bulletin, in which changes in administration are recorded, the social service worker has the latest information at hand. A comprehensive index adds to its usefulness.

Erratum.—In the issue of this Journal for July, p. 393, it was in error stated that the Journal of the British Dairy Farmers' Association is published by McCorquodale & Co., who are the printers of the publication. The publishers are the British Dairy Farmers' Association, 28, Russell Square, W.C.1.

QUESTIONS IN PARLIAMENT.

Farming Operations by Agricultural Executive Committees.—In reply to a question by Mr. E. Wood, the Parliamentary Secretary to the Ministry stated that an account of the farming operations undertaken by Agricultural Executive Committees on land of which possession was taken under the Defence of the Realm Regulations on the ground that it had not been properly cultivated had been prepared for the period from 1st April, 1917, to 30th September, 1919, which showed that the total payments and liabilities amounted to £653,890 and the total receipts and assets to £552,989, leaving a deficit of £100,901. The total area of which possession was taken amounted to 64,000 acres, but the Committees had withdrawn from possession of a considerable proportion, and the area which was still being farmed by the Committees amounted to approximately 20,000 acres. Much of the work of the Committees consisted of reclaiming practically derelict land, and in such cases a heavy initial outlay had to be incurred which could not be recouped in full in the first two or three years. (10th August, 1920.)

Double Sheep-dipping Order.—Captain Bowyer asked the Parliamentary Secretary to the Ministry whether he was aware that an order was issued in July for Leicestershire and Northamptonshire that all sheep were to be dipped twice within 14 days; that as a result of this order being carried out over 100 sheep had died; who was responsible for this order and from whom damages should properly be claimed; and whether he would cause the whole question of these sheep-dipping orders to be investigated so that at least sufficient notice should be given to prevent future orders overlapping, and to enable those affected to protest where necessary?

In answer, the Parliamentary Secretary stated that the reply to the first part of the question was in the affirmative, except that the order was issued on 26th June. As regards the second part a certain number of losses attributed to double dipping had been reported to the Ministry, but full details were not yet available. The double dipping order imposed in Leicestershire and Northamptonshire, according to which sheep have to be dipped twice within a period of 14 days in a dip approved by the Ministry, was one of a number of orders applied to various parts of England, Scotland and Wales in pursuance of the Ministry's policy for the eradication of sheep scab. The reports which had reached the Ministry indicated that the losses in question had been due to the use of a poisonous dip for the second dipping. In this connection it was expected that the advice given by the Ministry on the subject of the use of sheep dips, especially as regards the choice of a non-poisonous dip for the second dipping, would have prevented the losses in question. (11th August, 1920.)

Small Holdings and Allotments (Notices to Quit).—Sir K. Wood asked the Parliamentary Secretary to the Ministry whether he was aware that allotment holders in large numbers continue to receive notices to quit; that in many cases the notice was so short as 7 and 14 days; that the evictions of allotment holders would involve the loss of a considerable amount of food; and whether, in the public interest and in view of the need for increased production of food, he would take steps to remove the anxiety now existing among allotment holders by securing an Amendment of the legal provisions

and the regulations under the Defence of the Realm Act to provide that no notice should be valid which purports to terminate tenancies of allotments at less than six months, or some other reasonable period?

In reply the Parliamentary Secretary stated that he was aware that a certain number of allotment holders receive notices to quit from time to time, and that when, as was usually the case, the land was immediately required for housing or building the notice to quit was necessarily short, as every effort is made to retain the land under cultivation until the latest possible date. Although the need for increased food production was still urgent, he was of opinion that in the general public interest the retention of land as allotments could not be permitted to restrict the development of a town or to prevent the erection of houses, factories, works, etc. For this reason he regretted that it is not possible to adopt the suggestion contained in the last paragraph of the question. (23rd July, 1920).

Small Holdings.—In reply to a question by Mr. Cautley, the Parliamentary Secretary to the Ministry stated that the number of agricultural holdings exceeding 1 and not exceeding 50 acres in England and Wales in 1907, and in each succeeding year since that date was:—

Year.	Number.	Year.	Number.
1907	289,093	1914	291,722
1908	287,176	1915	289,689
1909	288,011	1916	284,153
1910	288,802	1917	278,556
1911	292,488	1918	275,334
1912	292,720	1919	272,568
1913	292,446		

(23rd July, 1920.)

Ecclesiastical Tithe Rentcharge (Rates) Act, 1920.—This Act received the Royal Assent on the 4th August. The Ministry of Health has issued to Town Councils, Urban District Councils, and Overseers, a circular letter enclosing copies of a memorandum with respect to the provisions of the Act and of the Order of the Minister of Health prescribing a form of statutory declaration as to income to be made by any incumbent who desires to claim under the Act exemption from rates on the ground that the total income arising from the benefice does not exceed £300, or an abatement on the ground that it is between £300 and £500.

The Circular and the Memorandum, Order and Regulations referred to in it will be placed on sale, and copies may shortly be obtained, either directly or through any bookseller, from His Majesty's Stationery Office at the following addresses:—Imperial House, Kingsway, London, W.C.2, 28, Abingdon Street, London, S.W.1, 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

Forms of statutory declaration for the use of incumbents will no doubt be printed by various local government publishers and will shortly be purchasable from them. It should, however, be clearly understood that they will not be supplied by His Majesty's Stationery Office or any other Government Department.

Rabies.—The Ministry of Agriculture and Fisheries announced on 17th August that, owing to an outbreak of Rabies at Wilton, near Salisbury, it had been found necessary to issue an Order imposing Muzzling Restrictions in what is roughly a twenty mile area surrounding that place, and embracing parts of the Counties of Wilts, Hants and Dorset. The boundaries of this Muzzling Area are, roughly, Bournemouth in the South, Winchester in the East, Wroughton in the North, and a point a little west of Maiden Bradley in the West. These boundaries are, however, only approximate, and in all cases doubt application should be made to the local Police or to the Ministry of Agriculture.

The effect of this Order is that no dog can be moved out of the Muzzling Area except by Licence of the Ministry, the chief condition of which is quarantine on veterinary premises for a period of six months.

The Area to which the Muzzling and Movement Restrictions apply did not then include the Boroughs of Winchester, Southampton, Leamington, Christchurch, Bournemouth and Poole, or any other of the South Coast watering places.

On 21st August it was announced that owing to the confirmation of a further case of Rabies in Marlborough, it had been found necessary to enlarge the Northern part of the original Muzzling Area which was announced on the 17th inst. This means that the boundaries of the Muzzling Area in Wilts, Dorset, Hants and Berkshire were roughly as follows:—Bournemouth in the South, points a little West of Newbury and Winchester in the East, roughly about three miles North of Swindon in the North, and points slightly East of Chippenham and West of Maiden Bradley in the West.

In a further notice of 24th August it was announced that a third case of Rabies had been confirmed at Salisbury, about three miles from the scene of the first case at Wilton. The Ministry had in consequence applied special regulations for the control of dogs to an Inner or Dangerous Area having a radius of about five miles round Wilton and Salisbury, which is in turn surrounded by the larger Muzzling Area declared on the 16th August and extended on the 21st August. In this Inner Area all dogs while in a public place are required to be led as well as muzzled.

No dog is allowed to be moved out of the Inner Dangerous Area, whether to a destination in the surrounding Muzzling Area or elsewhere, except by Licence of the Ministry of Agriculture, which requires the quarantine of the dog for six months on the premises of a veterinary surgeon approved by the Ministry.

Experimental Farm to Improve the Cultivation of Maize.—The Ministry is informed that a decree, dated 6th May, 1920, has been made by the Italian Government, which provides for the establishment at Bergemo of an experimental farm for the purpose of improving the cultivation of maize.

International Dairy Exhibition at Buenos Aires.—In the *Board of Trade Journal* for 12th August, 1920, it is stated that the Commercial Secretary to H.M. Legation at Buenos Aires intimates that it is intended to hold an International Exhibition of Dairy Stock, Products, Machinery and Implements at Palermo (Buenos Aires) in May, 1921. The programme is being compiled, and it is expected that copies will be available shortly, but in the meantime the Argentine Rural Society is causing the announcement of the

intention to hold the Exhibition to be circulated among live stock breeders, dairy farmers and manufacturers.

Wet Weather and Animal Disease.—The Ministry of Agriculture and Fisheries desires to draw the attention of farmers and others to the fact that the abnormally wet season may be followed by serious parasitic infection of animals and to remind all concerned that leaflets on internal and other parasitic diseases of animals can be obtained free of charge on application to the Ministry at 3, St. James's Square, London, S.W.1.

Leaflets issued by the Ministry.—Since the date of the list given on page 497 of the issue of last month's *Journal* the following leaflets have been issued in the *Permanent Series* :—

No. 349.—Methods of Obtaining Strong Stocks of Bees for Over-Wintering. (Formerly issued as Food Production Leaflet No. 55.)

„ 353.—Winter Oats. (Formerly issued as Food Production Leaflet No. 22.)

„ 354.—Jam-making when Sugar is Scarce. (Formerly issued as Food Production Leaflet No. 4.) (See page 512 of this issue.)

In addition, the information in the following leaflets has been revised and brought up to date :—

No. 20.—The Magpie Moth.

„ 231.—Cheese-making for Small Holders.

„ 276.—Commercial Mushroom Cultivation.

„ 324.—Buttermilk Cheese.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Netherlands Ministry of Agriculture, Industry and Commerce.—A General View of the Netherlands. No. 1. Agriculture and Cattle Breeding, and State Measures Furthering these Branches of Activity (210 pp.). Hague, 1915. [63.6(492).]

Netherlands Ministry of Agriculture, Industry and Commerce.—A General View of the Netherlands. No. II. Nurseries (32 pp.). Hague, 1915. [63.5(492).]

University of Leeds and Yorkshire, Council for Agricultural Education.—No. 73 :—Composition, Nutritive and Manurial Values of Farm Foods. [4th Revision] (2 pp.). Leeds, 1919. [63.604.]

India, Imperial Department of Agriculture.—Memoir No. 6, Vol. V., Chemical Series :—Absorption of Lime by Soils (16 pp.). Pusa, 1919. 2s. [63.113(54).]

Russell, E. J.—Regional Factors in Agriculture (7 pp.). (Reprinted from the Geographical Teacher, No. 56.). [63(04).]

Australian Imperial Force, Education Service.—A.I.F. Land Book No. 11 :—Tropical Agriculture (50 pp.). London : A.I.F. Administrative Headquarters, 1919. 1s. [63(024).]

Field Crops.

Union of South Africa, Ministry of Agriculture.—Report of the Departmental Committee on Wheat-growing, Appointed to Enquire into the Conditions of Wheat-growing in the Union (140 pp.). Cape Town : Cape Times (U.G. 42-19), 1919. 6s. 6d. [63.311(06) (68).]

South Australia, Department of Agriculture.—Bull. 127 :—Fodder Crops on Reclaimed Swamp Lands (16 pp.) Adelaide, 1919. [63.142(942).]

South Australia, Department of Agriculture.—Bull. 128 :—Ensilage, Its Manufacture and Use (19 pp.). Adelaide, 1919. [63.1985.]

Plant Diseases.

Taubenhaus, J. J.—A Contribution to Our Knowledge of Silver Scurf (*Spondylocladium Atrovirens Harz*) of the White Potato (12 pp.). (Reprinted from Memoirs of the New York Botanical Garden, 6 pp., 549-560, Aug., 1916). [63.24-33, 63.512(04).]

Sweet Pea Diseases and their Control (13 pp.). (Reprinted from the Trans. of the Massachusetts Horticultural Soc., 1916, Part I.), 1916. [63.52.]

Royal Society.—No. 6 :—Reports of the Grain Pests (War) Committee (51 pp.). London : Harrison & Sons, 1920. 2s. [63.27-31(06).]

Royal Society.—No. 7 :—Reports of the Grain Pests (War) Committee (52 pp.). London : Harrison & Sons, 1920. 2s. [63.27-31(06).]

Western Australia, Department of Agriculture.—Bull. 69 :—Take-All, Septoria, Rust and Wheat-Mildew. Practical Methods of Control (27 pp.). Perth, 1920. [63.24-31.]

U.S., Department of Agriculture.—Farmers' Bull. 1083 :—The Hessian Fly, and How to Prevent Losses from It (16 pp.). Washington, 1920. [63.27-31(73).]

Horticulture.

Steward, R.—Practical Hardy Fruit Culture (216 pp.). London : Swarthmore Press, 1920. 6s. net. [63.41(02).]

Abbay, Rev. R.—Our Orchards. Letters to the "East Anglian Daily Times," 1892-1920, with Notes (35 pp.). Earl Soham : The Editor, 1920. 1s. [63.41(04).]

Dillistone, G.—The Planning and Planting of Little Gardens (134 pp.). London : Offices of "Country Life," 1920, 6s. net. [63.5(02).]

Live Stock.

Rozeray, A.—L'Avenir de Quelques Bons Types d'Animaux Français sur Différents Points du Globe (37 pp.). Niort : Th. Mercier, 1919. [63.602.]

Dubois, Général.—La Crise du Demi-Sang Français. Evolution nécessaire (121 pp.). Paris : H. Charles-Lavauzelle. [63.613(44).]

Tuxen, S. C. A.—Husdyrbruget Den Almindelige Del. (3 Udgave). (238 pp.). Kjobenhavn : Gyldendalske Boghandel, 1906, Kr. 3.75. [63.6.]
Thompson, G. F.—A Manual of Angora Goat Raising, with a Chapter on Milch Goats (236 pp.). Chicago : American Sheep Breeder Co. Press, 1903. [63.638.]
Leyder, J.—Le Cheval Belge sa caractéristique et les conditions de son élevage (128 pp.) Bruxelles : Alfred Castaigne, 1905. [63.613(493).]
Union of South Africa, Department of Agriculture.—Bull. 2 :—Pigs and Piggeries. Pt. I. Breeding, Feeding and Management. Pt. II. The Design and Construction of Piggeries (55 pp.). Pretoria, 1919. 3d. [63.64(04).]

Veterinary Science.

Marshall, F. H. A. and Wood, T. B.—Physiology of Farm Animals, Part I., General (204 pp.). Cambridge : University Press, 1920, 16s. net. [619(02).]
Canada, Department of Agriculture.—Scientific Series No. 27 :—Warble Flies. *Hypoderma Lineatum, Villers*, and *Hypoderma Bovis*, De Geer. (24 pp.). Ottawa, 1919. [619.2(f).]63.62.]
Regnér, G.—Experiments with Conjunctival and Intracutaneous Tuberculin Tests (81 pp.). Edinburgh : W. & A. K. Johnston, 1920. [614.5.]

Economics.

Committee on the Increase of Rent and Mortgage Interest (War Restrictions) Acts.—Report of the Committee (14 pp.). London : H.M. Stationery Office (Cmd. 658), 1920, 2d. net. [333.5, 333.6.]
Ministry of Labour (Intelligence and Statistics Dept.).—Report on Profit-Sharing and Labour Co-Partnership in the United Kingdom (244 pp.). London : H.M. Stationery Office (Cmd. 544), 1920, 1s. net. [331.]
Farmers' Club Journal.—Part 3 :—Land Tenure (63 pp.). London : Farmers' Club, 2, Whitehall Court, S.W.1. 1920, 6d. [333.5.]
Royal Commission on the Income Tax.—Report of the Commission (186 pp.). London : H.M. Stationery Office (Cmd. 615), 1920. 3s. net. [336.24(06)].
Ministry of Food.—First Report of the Departmental Committee on the Wholesale Food Markets of London, 23rd February, 1920 (8 pp.). London : H.M. Stationery Office (Cmd. 634), 1920. 1d. net. [381.1.]

Dairying and Food, General.

Royal Agricultural Society of England.—Report of the Steward of Dairying, Cardiff Show, 1919 (19 pp.). London : The Society, 16, Bedford Square, W.C.1., 1919. 6d. [63.70(06).]
Tisdale, C. W., and Jones, J.—Butter and Cheese (142 pp.). London : Sir Isaac Pitman & Sons, 1920. 2s. 6d. net. [63.70(02).]
Macgregor, A. S.— Milk Supply in Copenhagen (37 pp.). Edinburgh : Ssott & Ferguson & Burness & Co., 1890. 1s. [63.71(489).]
Kjeldsen, C. M.—Malkekvaegets Fodring, Rogt og Pleje (78 pp.). Kobenhavn : Gyldendalske Boghandel, 1915. Kr. 1.00. [63.711.]

Birds, Poultry and Bees.

South Australia, Department of Agriculture.—Fertilization of Hens' Eggs. A Record of Experimental Work in Deciding the Duration of the Influence of the Male Bird (6 pp.). Adelaide, n.d. [63.651.]
Geary, H.—The Beekeepers' Vade-Mecum (202 pp.). London : Stanley Paul & Co., 1920. 2s. 6d. net. [63.81 (02).]
N.S.W., Department of Agriculture.—Farmers' Bull. 129 :—The Beginner in Bee Culture (19 pp.). Sydney, 1920. [63.81(04).]

Forestry.

Cambridge Forestry Association.—The Archives of the Association, 1919 (12 pp.). Cambridge : University of Cambridge School of Forestry. 1919. [63.49(06).]

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